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QUARTERLY

OF THE

National Fire Protection Association

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EDITED BY THE SECRETARY

National Fire Protection Association.

Executive Office, 87 Milk Street, Boston, Mass.

Active Members.

October 1, 1914.

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American Institute of Electrical Engineers.
American Institute of Heating and Ventilating Engineers.
American Institute of Mining Engineers.
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National Association of Manufacturers of United States.
National Assn. of Master Gravel and Slag Roofers of America.
National Automatic Sprinkler Association.
National Board of Fire Underwriters.
National Convention of Insurance Commissioners.
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National Implement and Vehicle Association.
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Western Sprinklered Risk Association.
West Virginia Inspection Bureau.
West Virginia State Fire Prevention Association.
Wisconsin Inspection Bureau.
Wisconsin State Fire Prevention Association.

Table of Contents.

Uniformity of Cornice Line in Vienna ..... Frontispiece
Editorial 133
The Chapters 142
Members' Activities 144
Mrs. O'Leary and Her Cow 146
Fire Prevention Questions for School Children. *W. E. Longley* 147
Typical Carelessness with a Chimney 148
Wooden Roofs on Fire-Resistive Buildings 149
Gasoline Fires Caused by Frictional Electricity 152
Hose Streams on High Tension Wires 153
Fire Department Civil Service Examinations 159
Regulating Building Heights 176
Killed by a Fire Door 200
Spontaneous Combustion in Burlap 202
Field Tests of Dry Pipe Valves. *Albert Blauvelt* 203
Department of Fire Records 207
Laundries—Fire Record 208
General Fire Record 217
Fires in Which There Was Loss of Life 224
Points of Interest from Fire Reports 230
Fire Causes 233
Standard Rules and Requirements 240

Reports on fires appearing in the Quarterly are copies of or extracts from written reports forwarded to the Association. This Association, as a body, is not responsible for the statements or opinions of any of its members.

Effect of Height Limit on Uniformity of Cornice Line in Vienna.

See Regulating Building Heights.

The Quarterly

Vol. 8 October, 1914 No. 2

The Commissioners and the Marshals.

The meeting at Asheville, N. C., in September, of both the National Convention of Insurance Commissioners and the Fire Marshals' Association of North America, one following the other, gave those who are interested in the work of both bodies a favorable opportunity to study the character and efficiency of these two organizations in juxtaposition. While it is the common opinion that the Commissioners constitute the more important body, this idea deriving probably from the fact that the influence of the office is more extended, it was interesting to observe that at Asheville the deliberations of the Fire Marshals were quite the equal in earnestness and dignity of those of the Commissioners and that the personality of the officials of the two organizations was quite on an equal plane of excellence.

Both of these admirable associations contend with a common handicap, well understood by them, which impairs their continuity of effort. This handicap is the hazard of political fortunes. In both, the selection of officers must be confined to those members whose office "holds over," to avoid decimations by political reverses in the middle of the Association's fiscal year. Even at the best the main bulk of the membership is completely changed every half dozen years. The cumulative judgment and experience so helpful in the N. F. P. A. are largely denied to these sister organizations, who must by the nature of their constituency make each new administration largely an adventure of faith. That progress is not baffled by this circumstance is due to the amazing adaptability of the men in the political life of America. The value of the literature accumulated by each association is obvious; it is the point of departure for each new official as he takes up his portfolio, and he "seasons" what he reads in the contact of minds at the annual conventions. The paper read by Commissioner Robert J. Merrill of New Hampshire was full of thought-provoking irony in its treatment of the general subject of an Insurance Commissioner's official possibilities.

Both the Insurance Commissioners and the Fire Marshals took advanced ground this year in the matter of fire prevention. The Commissioners pledged themselves by resolution to aid the N. F. P. A. in its

campaign for the establishment of the office of fire marshal in every state, and for the furtherance of this special work President Darst appointed as chairman of the Committee on Publicity and Education an exceptionally able and active commissioner, O. K. Stablein of South Dakota. The Fire Marshals also passed excellent resolutions, and elected as their president, Harrison Parkman of Kansas, a member of the Committee on Public Information of the N. F. P. A., who is preparing for our Association a special pamphlet on the value of the fire marshal's office.

* * * * *

Commissioner Nesbit's Observations. The new Superintendent of Insurance for the District of Columbia, Mr. Charles F. Nesbit, made his official bow to the Convention this year with a paper on Fire Insurance premiums and the Fire Waste. Mr. Nesbit's was the only fire-prevention paper presented and it was heard with lively interest by the Commissioners because of its direct and succinct treatment of the subject of public rating. Mr. Nesbit cleared up some prevalent mental confusion by showing that "public" rating was not necessarily "state" rate-making. He said:—

If rates can be so fixed as to exert a permanent and powerful influence on the fire waste, it seems to me evident that this object should be definitely kept in mind in all public rate making.

The new era of rate making has not come suddenly, like a thief in the night. It is an evolution and a development. The companies themselves have recognized it, and their schedule ratings have for years shown their earnest endeavor to secure a scientific basis for just rates.

In the prevention of fire waste, the insurance companies, through the National Board, and through their support of the National Fire Protection Association, have rendered a commendable and distinct public service. This is no essential part of their business as sellers of insurance, and should be credited to the patriotism, the humanity and the moral sense of the men who have volunteered this great public service.

The methods of reducing fire waste are primarily, education, which is reflected in public opinion, and secondarily, legal enactments regulating the character of buildings, the handling of explosives, provision for extinguishing fire, etc.

I submit that in the fixing of insurance rates education is equally necessary; that one of the objects to be accomplished by public rate making shall be the elimination of defects and hazards.

The new era marks a tremendous step forward from conditions obtaining comparatively few years ago.

When the competition between companies and between agents for business enabled men to effect insurance on almost any kind of a risk, and when the rates were determined not by the quality of the hazard so much as the competitive desire to secure the business, we can readily understand that the criminal fire waste of this country was directly stimulated by such conditions.

The present agency system, in so far as its method of compensating agents by a fixed commission on all business written, is a relic of this competitive era. This system is responsible, more than any other one thing, for having cheapened in public estimation the fire insurance business. This system tends to rob the agent of any incentive to become an underwriter, or to understand principles governing the business. The agent's sole purpose tends to become that of getting a given volume of premiums, and he must be a man of exceptional character who refuses hazardous risks from a physical standpoint, or even more hazardous risks

from a moral standpoint, when his self-denial in the company's interest has not only no reward, but rather financial punishment and loss. It is to the credit of the great body of agents that in spite of this system, they maintain so high a character of business dealings. The fire insurance business will never be of the importance in assisting in the reduction of fire waste it should be, until the agent is made an underwriter, and until his reward or compensation bears a direct ratio to his success as an underwriter rather than simply to his ability to secure volume of premiums.

The competitive era resulted in a false education of the public, which scientific schedule rating is already doing much to correct. The insurance departments occupy a position between the companies on one hand and the public on the other, and they are charged with a peculiar responsibility during these first years of recognized public rate making.

Since preparing this paper, and since coming to this convention, I find a resolution already prepared which, if adopted, as I am certain it will be, will put this body on record as favoring the heartiest co-operation between the companies and it, in the uniformity of schedule rating and classifications, in the uniformity of reporting losses, and of tabulation of classifications of hazards.

The heartiest co-operation between all the departments and all the companies, with a uniformity of classification and loss reporting throughout the whole United States, is essential if public rate making is to evolve normally. It will require patience, tact and the most earnest effort on the part of both companies and departments to work out a satisfactory public rate.

A part of its success must be such adjustment of rates as will tend to force those betterments of condition and those safeguards which will reduce, year by year, the fire waste of this country.

Mr. Nesbit's treatment of the subject of the insurance agent will appeal to all thoughtful people as sane and just, and the generous praise he bestows upon the insurance companies composing the National Board of Fire Underwriters for their fire prevention work should be emphasized to the general public. "This is no essential part of their business as sellers of insurance," says Mr. Nesbit, "and should be credited to the patriotism, the humanity and the moral sense of the men who have volunteered this great public service." The false education of the public, to which Mr. Nesbit refers, is responsible for the prevalence of the singular notion that it is the logical business of insurance companies to conduct fire prevention campaigns. From this notion springs the common assumption that it is logical to saddle the cost of the fire marshal's office upon insurance companies as the only parties interested in preventing the fire waste. The people never will realize that the fire waste is their own affair, until the fire marshal is recognized as their own officer, and relieved of his dependence upon an interest which should no more support him than the life insurance companies should support the boards of health.

* * * * *

Real Statistics Promised.

Mr. Nesbit refers to a resolution, which was subsequently adopted, which marks a prospective new era in the gathering of fire loss statistics in this country.

It is a growing habit of the states to require of the fire insurance companies reports of all fires in insured property occurring within their boundaries. The states furnish the blanks for these reports and the blanks

of no two states are alike. The prospective burden upon the companies as this practice increases is obvious. To meet this undesirable situation the National Board of Fire Underwriters through its actuarial committee, headed by Mr. E. G. Richards, comes forward with the proposition to establish at large expense a loss bureau which shall operate a uniform system of classification of amounts (risks) written and of losses incurred. Mr. Richards' committee has already worked up a standard classification of occupancy hazards and a loss report form and list of fire causes.

It was to this general plan that both the Insurance Commissioners and Fire Marshals pledged their co-operation by suitable resolutions. It means the establishment of a single source of information on fire causes and losses in insured property which shall be accessible to anyone.

The National Board of Fire Underwriters thus proposes to undertake a work of profound importance. It is only through such service as this that uniform and combined experience of value for rate-making purposes may be obtainable. Every company writing fire risks should co-operate in this big work of the National Board, and the Insurance Commissioners should exert their influence to this end. It is the friendly, frictionless way of accomplishing a result all the departments have been crying for, but which has heretofore seemed impossible of realization.

* * * * *

Wisconsin's Building Code. One by one the states are wrestling with the problem of a state building code. Wisconsin is the last to complete such a measure which becomes effective on all buildings not exempted for which contracts have not been let before October 15, 1914. Wisconsin has a reputation for doing things the easiest way. Her new code did not have to pass the legislature, with interminable delays and paroxysms of private interests over each paragraph. The law gives the Industrial Commission power to prescribe such regulations as shall make places of employment and public buildings "safe." The Industrial Commission prepared such regulations and has issued the same as a building code in an attractively printed pamphlet of one hundred pages. In a small leaflet accompanying the publication which contains data on a number of fires involving loss of life the Commission says:—

> Why does the State of Wisconsin, through the Industrial commission, adopt rules regarding the design and construction of buildings? It is natural for this question to be asked by the man who has owned or managed a theatre, hotel or factory for many years without ever having a fire, or ever knowing of a serious fire or collapse in the town where he lives. Why should the state require stairways and fire escapes of specified number and size; protection of boilers, furnaces, stoves, smoke pipes, steam and hot air pipes, chimneys, lights, electric wiring; fire-resisting construction in some cases; enclosure of stairways and elevators in some cases; fireproof curtains and fireproof moving picture booths in theatres, and so forth?
>
> These things are required because actual experience in Wisconsin and other states has proven that they are necessary for reasonable safety to life.
>
> Experience has also shown (though this is not the purpose of the state law) that the fire protection here required is a sound business investment.

The Wisconsin law is so broad as to give the Commission power over practically all buildings except private residences. The Commission plan of operating a building code certainly has the virtue of flexibility. The chief outcry in the other states attempting state regulation has been against the rigidity and consequent embarrassments of a code expressed in fixed terms of law. In its introduction to the Code the Wisconsin Commission has this to say:—

Purpose of the Code.

A state building code, if it is to be efficient without being unduly restrictive, must confine itself to broad general requirements of fire protection, sanitation, and structural safety. Technical details must be avoided except where they are needed to give meaning to the general requirement. In other words, the code should specify results only, giving free rein to the originality of the architect or engineer to secure such results by the most economical and efficient means. Even such matters of detail as are properly included in city building ordinances must often be excluded from the state code. This refers especially to details of engineering design, which it would be useless to include in a state code because they could not be enforced by local officials without technical training.

The experience of other states, where a multiplicity of detail in building laws has antagonized designers and defeated its own purposes, has proven that these dangers are real. The Wisconsin code has sought to avoid them.

It has been the especial aim of the framers of this code to include only such requirements as are based on actual experience and standard practice. The code is not put forth as an ideal standard of building construction, but simply as the best standard which can reasonably be enforced throughout Wisconsin at the present time. The desirability of such a code is indicated by the large loss of life through fire or panic in different parts of the country in recent years. The Iroquois theatre fire in Chicago, the Collinwood school fire in Ohio, the Triangle Waist Company fire in New York, to quote only the most prominent instances, have caused legislation along these particular lines, in their respective localities and elsewhere, which is much more drastic than the requirements here proposed. It is hoped that the moderate requirements of this code will prevent or at least minimize the possibility of such catastrophes in Wisconsin.

The code attempts to protect life by means which will at the same time protect property. Such protection is not a burden but a sound business investment.

Administration.

The building code will be enforced in co-operation with local officials, who are required by law to enforce all orders of the commission which are germane to their respective duties (Sect. 2394-70). With the state code as a foundation, city ordinances may go more into detail, if desired, or may contain more stringent requirements than those of the state code.

To secure the best results, plans should be filed with and approved by a city building inspector. This is now required in Milwaukee, Superior, and Madison, and for buildings within the fire limits in other cities. The Industrial commission strongly recommends all cities to require such building permits and thus prevent the construction of buildings which will endanger the lives of citizens and increase the possibility of a disastrous conflagration.

When local permits are not required, the commission will be glad to examine any plans which may be submitted by architects or owners who wish to protect themselves against the possibility of having to make future changes to conform to the code. This is especially suggested in the case of theatres, schools, and other large buildings. If a building is erected in violation of the code, the owner may be required to correct the defect, and may also be held for a penalty of from ten to one hundred dollars for each day of violation.

Appeal.

Any person who considers any part of the building code, or any local official's interpretation of the code, to be unreasonable, may appeal to the commission to interpret, modify, or suspend the same. As the building code is not a statute but an administrative order of the commission, it may be so interpreted, modified, or suspended by the commission at any time. The subject of building design is so complex, and the situations which may arise are so various, that such exceptions will doubtless have to be made from time to time. The same procedure applies to the recognition of new building materials or systems of construction.

Bulletins.

Education is more potent than regulation. The building code, though regulatory in form, aims simply to present to the people of Wisconsin the accumulated experience of the state and the United States as to what precautions are necessary to make buildings reasonably safe. The commission intends to supplement this by issuing bulletins from time to time describing new developments in building design and construction, and also describing any important fires or collapses which occur. The commission believes that every owner wants to make his building as safe as possible and that he only asks to be shown what safeguards have been proven necessary by experience.

There is no doubt that most right-thinking citizens of Wisconsin will fully endorse the action of the Industrial Commission in assuming the largest responsibilities possible under the law and proceeding to adopt and enforce a building code. It is to be regretted that the statute cannot be stretched to cover single and two-family dwellings in which there is a continual loss of life by fire. Mr. Sidney J. Williams (Member N. F. P. A.), Building Inspector for the Commission, whose personal contribution to the work of the state code was very great, says in a recent letter to Secretary Wentworth:—

I mentioned to you in Chicago that the loss of life in small fires would probably be found to be as great as in the large catastrophes about which we hear. I recently looked over the newspaper clippings which we receive from time to time, and find that in Wisconsin in the months of January, February and March of this year a total of thirty-four fatalities occurred in fires. Out of this number four lives were lost in a village hotel and two in a cheap hotel in Milwaukee; the others were almost entirely in private houses.

It is believed that Mr. Williams will be willing to send a copy of the new Wisconsin Code to members of the N. F. P. A. especially desiring it who may address him at Madison, Wis., enclosing six cents in postage.

* * * * *

Automatic Sprinklers Mandatory. While the states are evolving building codes the cities are seeking by law to secure more widely extended automatic sprinkler protection. Here, too, there are alternative methods; the code or ordinance may demand such installations in all buildings or situations of specific character, or the authority to order installations may be vested in the fire commissioner or other officer. Rochester, N. Y., is experimenting with the first

method, Boston and New York City with the second. Following is the section of the Rochester building code relating to the subject:—

Sec. 286. Sprinkler Pipes in Basement and Cellar.

1. In every building within the fire limits intended to be used for mercantile, manufacturing or storage purposes, there shall be provided a system of automatic sprinklers placed at the ceiling of each story below the first, and extending to the full depth and breadth of the building. (Fire limits defined, Sec. 308.)

2. Said sprinkler pipes shall be connected with a pipe leading to the outside of the building, and there provided with a Siamese steamer connection uniform with that used by the fire department of the city.

It will be observed that the language of the above sections is ambiguous. A "system" of automatic sprinklers is usually interpreted to mean sprinkler heads on pipes permanently connected to a water supply, so that the water is ready to do its work of fire extinguishment as soon as the heads open. The second paragraph suggests that dry pipes into which the fire engines may pump on their arrival may adequately meet the code requirement. This would rob the equipment of its automatic feature which is its chief virtue. If the code might be interpreted to require the steamer connection in addition to a regular water supply from tank or city service a standard installation would be more nearly approximated. Non-enforcement is the usual result of ambiguous statutes.

On the other hand where the fire commissioner is responsible, and installations are to conform to a standard in his judgment suitable, the flexibility noted in connection with the Wisconsin building code is present. Rebellious property owners cannot hide behind technical barriers and weak or timid fire marshals or building commissioners cannot find an excuse for inaction. Since the July Quarterly was published the New York court of appeals has upheld the conviction of Charles Kaye, who refused to install an automatic sprinkler system in his loft building at 30-34 West Twenty-fifth Street and was convicted in special sessions and fined $25. This decision was upheld by the appellate division of the supreme court, and has now again been sustained on appeal to the higher court.

The decision is of great importance as establishing the power of the fire commissioner to require such installations.

The Kaye Building was chosen for this test because it was in type of construction and physical arrangement practically a counterpart of the Asch Building, where 145 lives were lost in the fire of March 25, 1911. It is twelve stories in height, and when the sprinkler order was served, April 8, 1912, there were 526 people in the building. On October 17, 1912, when Kaye was charged with having disobeyed the order, there were 650 people in the building, of whom 275 were on the eighth and higher floors.

Prosecution of a number of other offenders will follow unless they comply with the fire commissioner's requirement. The brief filed with the court of appeals says:—

This is a test case; for, following the examples of the defendant, Kaye, many other owners of dangerous factory buildings have refused to comply with the order

of the Fire Commissioner, requiring the installation of automatic sprinklers, and the prosecution of these offenders has been postponed, pending the determination of this appeal.

There are approximately 5,000 factory buildings in the city having an aggregate daily occupancy of over 500,000 people. Two thirds of these toilers are women who, as a rule, are employed in factories the fire conditions of which are extra hazardous. Indeed, women predominate in nearly every industry where great numbers of people are working upon highly inflammable materials in great, open lofts, as in the Kaye Building.

The purpose of the prosecution of the defendant has been to bring home to him, and to other offenders of his class, that they will not be allowed to shirk their plain duty to provide adequate means for the efficient protection of occupants of their buildings against fire and fire panic. Kaye's crime, while technical, might have had serious results. For over two years he has neglected and refused to provide the means deemed necessary by the Fire Commissioner to safeguard the lives of the 650 occupants of his loft building.

The Governor of Massachusetts has now appointed the fire prevention commissioner for the Metropolitan district of Boston, with very real powers, and the case above cited will undoubtedly be of service in influencing citizens with hazardous occupancies to comply with the commissioner's orders.

* * * * *

Fixing Individual Responsibility. When the July QUARTERLY went to press the text of the resolution passed unanimously by the National Association of Credit Men following the address of the Secretary of the N. F. P. A., at their 1914 Convention in Rochester, was not available. It has since been furnished by Secretary Tregoe's office. The resolution was offered by Mr. E. L. McClure of Kansas City and is as follows:—

WHEREAS, A large percentage of our annual fire waste is due to contributory negligence on the part of owners of property, and

WHEREAS, A large portion of this waste could doubtless be eliminated through corrective statutory measures, be it

Resolved, That we recommend to the incoming Fire Insurance Committee that they investigate as to whether the owner of property who brings fire loss upon a neighbor, as a result of failing to correct an extra hazardous risk in his own property, cannot be made financially responsible by legislative action to those suffering such a loss as a result of his negligence.

The National Association of Credit Men is the first of our active members to take up the most fundamental item in the list of fire prevention measures,—fixing individual responsibility.

* * * * *

Mr. John L. Noble, Member N. F. P. A. As we compare our year book of 1914 with our year book of, say 1904—ten years ago, the growth of our membership, both active and associate, seems as rapid as the most sanguine of us might expect. The slow awakening of North America to her impoverishment by fire has brought us a steady stream of adhesions from those whose interest has been thus

aroused. On alternate years we have asked every member to bring in another—at least one. We asked this of our members this year and a goodly number responded, some with more than one. But it was our Canadian member, John L. Noble of Victoria, B. C., who distanced all others and demonstrated what the possibilities of energetic action and loyalty may be. Mr. Noble sent in applications for *twenty-four* associate memberships from Vancouver Island with a modest note expressing regret that he could not do better!

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"Field Practice"—the N. F. P. A. Manual. Our members from Halifax to San Diego who are impatient for the appearance of our inspection manual (which is to be called *Field Practice* for an original title) will be glad to know it is now about ready for the printer and it is hoped may be bound and ready for delivery by December 1st. Three devoted members of the Association have spent many hours in the revision of certain sections which were believed to need further consideration. These members are Chas. H. Patton, of Cleveland, Chairman of the Committee on Field Practice; F. J. T. Stewart of New York, Chairman of our Executive Committee, and J. O. Hammitt of New York, Chief of the New York Fire Prevention Bureau. In its final form the manual is now satisfactory to such representative members as the New York Board of Fire Underwriters and the New York Fire Prevention Bureau, which is a fair indication that the other underwriting and municipal departments in our membership will find little in it to complain of. The unabated interest of Chairman Patton in the production of *Field Practice* is manifested by his two special journeys from Cleveland to New York for his conferences with Mr. Stewart and Mr. Hammitt. The potentialities of *Field Practice* for service to inspectors of every sort make it well worth the generous labor our members have put into it.

The Chapters.

Boston.

Boston Chapter has undertaken actively to support the efforts of the new fire prevention commissioner for the metropolitan district. The new law which has just become effective by the appointment of Mr. John A. O'Keefe of Lynn as fire prevention commissioner gives the latter large powers and places upon him large responsibilities. Automatic sprinklers may be ordered into any building which in the judgment of the commissioner should be so protected; new rules must be drafted for the handling of explosives and also of inflammable liquids. The responsibility for fire drills in the public schools and the education of the children in fire prevention also falls upon the commissioner. On October 5th a special meeting of the Boston Chapter was held at the City Club, the fire prevention commissioner being the guest and speaker. The members of the Chapter responded so enthusiastically that the accommodations reserved at the Club were insufficient. The new commissioner made a very favorable impression upon the members to whom he appealed for sympathy and support in the efforts he is determined to make. Adjutant General Cole, president of the Chapter, presided and pledged the co-operation of the Chapter in the work of the commissioner. The latter has become a member of the Chapter and means to call the members to his assistance in the consideration of important matters in connection with the administration of his office.

Chicago.

Chicago Chapter concentrated its efforts on a proper observance of Fire Prevention Day in the Western metropolis. The Chapter co-operated with the City Fire Department and the Building Department in preparing an unusual demonstration of the effect of fire on buildings. Two cottages, one of brick with non-combustible roof and one of frame with shingle roof, were erected on the lake front at the foot of Van Buren Street and at 12.30 o'clock noon were set on fire. The fire department made a spectacular run down Michigan Avenue, which had been cleared for the purpose, and extinguished both fires. The frame building was a wreck. The damage to the brick structure was confined to the interior fittings, the building itself being intact. The principal purpose of the exhibition as announced in the attractive invitations issued by the Chapter was to arouse public sentiment in favor of the ordinance for the extension of the fire limits which is to come up this month in the city council.

In the evening the Chapter held a special meeting in the assembly

room of the Insurance Exchange, at which the general subject of the work of municipal and state departments in reducing the fire waste was considered. The following members of the Association delivered addresses: Mr. John C. McDonnell, Chief, Bureau of Fire Prevention and Public Safety, subject—"What Chicago is Doing to Reduce the Fire Waste"; Mr. Thomas R. Weddell, Chairman, Committee on State Fire Prevention Associations N. F. P. A., subject—"What Other Cities are Doing to Reduce the Fire Waste"; Mr. F. R. Morgaridge, Assistant State Fire Marshal, subject—"What the State of Illinois is Doing to Reduce the Fire Waste." There was a fine attendance and the officers of the Chapter feel that its first attempt at a big local work was successful in every way.

New York.

A meeting of the New York Chapter was held at the City Club Monday evening, October 12th, at which Mr. Ira G. Hoagland, Secretary of our active member the National Automatic Sprinkler Association, delivered an address: "Some Things About the Salem Fire." Mr. Hoagland illustrated his talk with lantern slides and brought the pertinent points of the Salem conflagration clearly and effectively before the meeting.

The Chapter assisted in New York's wide observance of Fire Prevention Day October 9th by furnishing its president and its secretary, Rudolph P. Miller and Edward R. Hardy as the speakers at an assembly of the inspectors of the Bureau of Buildings of Manhattan.

Members' Activities

Robert C. Bird, New York, was official N. F. P. A. delegate to the convention of our active member the American Electric Railway Association at Atlantic City, October 12-16.

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Washington Devereux, Philadelphia; J. E. Latta, Chicago, and Charles H. Lum, New York, were official N. F. P. A. delegates to the nineteenth annual convention of our active member the International Association of Municipal Electricians, at Atlantic City, September 15-18.

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We have received from our one member in India, Mr. Bernard A. Westbrook, Chief Officer of the Calcutta Fire Brigade, the annual report of that body containing an interesting map of Calcutta with the year's fires dotted in red ink in their various locations. It is an original and graphic way of telling the story. In certain districts there are no water mains, the only water supply being ponds, many of which are now being filled up for sanitary reasons. In one case Chief Westbrook had to use 300 lengths of hose at a single fire, and 200 lengths at another, which indicates one of the difficulties with which he contends.

* * * * *

The Louisiana Chapter of our active member the American Institute of Architects rendered good service at Baton Rouge during the last session of the legislature. A bill to abolish the Louisiana Fire Prevention Bureau was met by a petition representing the recognition by the larger part of the architects' profession of the excellent and necessary service rendered by the bureau. The presence of members of the Chapter and their influence assisted in defeating the bill.

* * * * *

Messrs. George W. Babb, New York; W. E. Mallalieu, New York; Willard Done, San Francisco; Oscar B. Ryon, Chicago; and Secretary Franklin H. Wentworth attended the convention of our active member the National Convention of Insurance Commissioners at Asheville, N. C., September 15th to 18th. Messrs. Mallalieu, Ryon and Wentworth also

attended the annual convention of the Fire Marshals' Association of North America held in Asheville the previous week.

* * * * *

Commissioner James R. Young of North Carolina has put into operation his plan to send a fire department expert into the cities of the state for the purpose of educating local firemen. Ex-Fire Chief Brockwell of Raleigh is now engaged in this useful work.

* * * * *

Mayor James M. Curley of Boston has appointed three members of the N. F. P. A. upon a committee of four to consider the fire hazards of Metropolitan Boston and prepare suitable recommendations for submission by the Mayor to the legislature to reconcile differences in building requirements in the cities of the metropolitan district. Messrs. F. R. Bangs, C. H. J. Kimball, and Secretary Wentworth are the members appointed. The committee is already in conference with the new fire prevention commissioner and the State Building Code Commission.

* * * * *

Secretary Franklin H. Wentworth of Boston and Alcide Chausse of the Montreal Chapter were speakers at the twenty-first annual convention of the American Society of Municipal Improvements at the Somerset Hotel, Boston, October 7th.

* * * * *

Mr. A. R. Small, Chicago, delivered an address on "The Underwriters' Laboratories: Its Work in the Field," at the convention of the Fire Underwriters' Association of the Northwest in Chicago, October 7th, preceding a visit of the members of the Association to the Laboratories.

* * * * *

The Committee on Explosives and Combustibles held a two days' meeting in Philadelphia September 23d and 24th. Chairman Charles A. Hexamer has sufficiently recovered from his long illness to be again at his desk in Philadelphia.

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Secretary Wentworth spoke at the mass meeting held under the auspices of the Philadelphia Safety Council at the Bellevue-Stratford Hotel, Philadelphia, Thursday evening, September 24th.

* * * * *

Vice President Gilbert A. A. Pevey of Boston Chapter N. F. P. A. delivered an address on Fire Prevention at the annual convention of the National Association of Mutual Insurance Companies at Columbus, O., last month.

Mrs. O'Leary and Her Cow

A "Rymbel."

The *Century* Magazine has lately been experimenting with a new form of light verse which it calls the "rymbel." The idea of the "rymbel," as we understand it, is that the last word of every verse be the first word of the following verse, but (where the writer is clever enough) that the meaning be entirely different. The *Century* evidently thinks this sort of literary juggling a recent invention, but we believe it has more remote progenitors.

It serves to recall the fact that many years ago on the occasion of the death of Mrs. O'Leary who was milking the cow that kicked over the lamp that set fire to Chicago, Mr. W. J. Lampton wrote for the *New York Sun* something like the following:—

Dead is Mrs. O'Leary: dead in Chicago now,
Finished her earthy labours; gone to join her *cow*.

Cow that is ever famous; more than heart could desire,
Famous because she started the great Chicago *fire*.

Fire that swept the city, city of brick and frame
Went up in a blaze of glory, that brought undying *fame*.

Fame for being a bigger fire than ever blazed
In any other city and left the world *amazed*.

Amazed that from her ashes Chicago could arise
And grow with magic swiftness to such enormous *size*.

Size that is simply wondrous, distending everywhere
With the wind which is, de facto, coagulated *air*.

Air that is filled with thickness, that makes her sun as red
As the blood in her slaughter houses, where the wine of her life is *shed*.

Shed that her wealth and glory might decorate the brow
Of the one and only city kicked to fame by a *cow*.

Cow of Mrs. O'Leary, a lamp, a kick, and a shed,
A wonderful combination numbered now with the *dead*.

Dead is Mrs. O'Leary, gone to the bye and bye.
Go build her a tomb of granite—a hundred stories high.

Fire Prevention Questions for School Children.

By W. E. Longley (Member N. F. P. A.).
State Fire Marshal, Indiana.

Do you use safety matches?

Are floors under stoves protected, and how?

Are walls, ceilings and partitions protected from overheating of stoves or furnace?

How are ashes disposed of?

Of what material is the house?

Of what material is the basement?

Is basement or foundation inclosed?

Are chimneys built on the ground or on brackets?

Are chimneys in good repair?

Do stovepipes pass through attic, closets or unused rooms?

Do stovepipes pass through partition without metal protectors?

Do you keep gasoline? Where and how?

Do you use stoves or furnace? What kind?

Do you use kerosene?

Have you any fire extinguishers?

Are you familiar with the location of the fire alarm box nearest your home? Where is it?

Do you know how to turn in an alarm?

Do you know the telephone number of the fire department?

Name any unsafe conditions that exist in or about your home.

Children intelligently answering these questions will be good home Fire Wardens.

Photo by Harry A. Fanckboner, Michigan Inspection Bureau (Member N. F. P. A.).

Typical Carelessness with a Chimney.

Failure on the part of a new tenant to properly examine the chimney before attempting to use it was responsible for the fire, the result of which is illustrated in the accompanying photograph.

The chimney passed up the outside of the building, a hole having been left in the wall for inserting the stovepipe. Unknown to the owner, he claims, the hole in the chimney was plastered up, probably several years ago, when the building was remodeled, but the pipe hole in the interior walls was left unchanged.

A new tenant placed a stove in the room, inserting the pipe in the hole, thinking it led into the chimney. Instead, however, the pipe merely led the smoke and sparks into the hollow wall, and the day after the stove was set up, in the early morning, the building was discovered on fire in the wall. After extinguishing the fire, which spread into the attic, with considerable damage by water, the condition of the chimney was discovered by a truck company captain, who picked into the plaster and found it entirely covered the hole in the chimney.

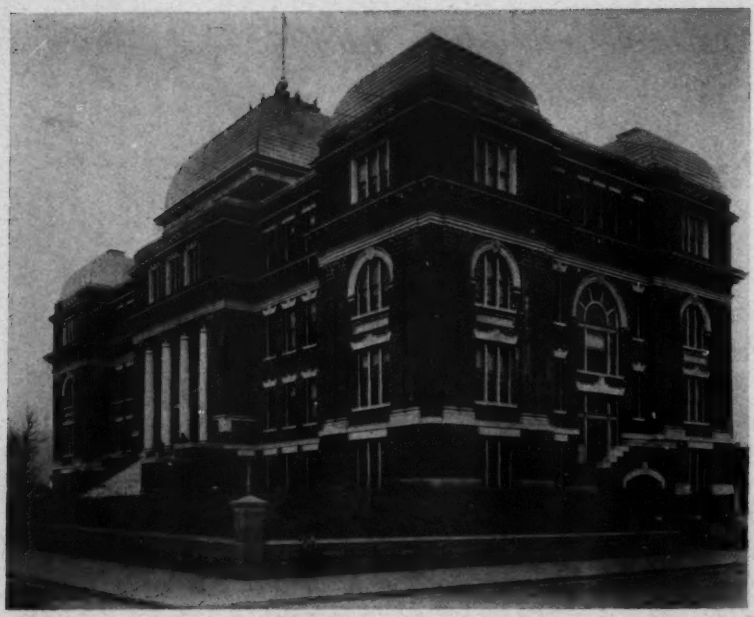
The photograph shows the plaster which covered the hole in the chimney (just above and to the right of the stovepipe) and also the hole made in the plaster by the fireman. Aside from the closing up of the chimney hole, a very hazardous condition was revealed by the fire in the close proximity of the wood to the stovepipe.

Courthouse, Paris, Kentucky. Wood construction above the first elevation of the tower.

Wooden Roofs on Fire Resistive Buildings.

A gradually awakening public intelligence in fire protection matters is bringing an increasing condemnation of the foolish practice, much too common in public buildings, of placing wooden roofs on structures otherwise safely constructed of fire resistant materials.

There are here given photographs of a public school building in Hot Springs, Ark., which is typical of this kind of construction and of the disaster to which it is the easy and logical prey. With a proper roof no such extensive damage as was suffered by this building would have been probable or possible where the local fire department was efficient. We are advised by a Western member that a number of school districts throughout the Central West appear to be erecting so-called fireproof buildings, which are not fireproof because of combustible roofs, on the plans of a Minneapolis architect.



Hot Springs, Ark., school before the fire, showing combustible roof.

Mr. Frank M. Drake furnishes us with a photograph of a building in which this fault is aggravated by special conditions—the attractive new courthouse in Paris, Ky. Commenting on this Mr. Drake says:—

This is one of the handsomest public buildings in a small town in this country. Paris has a population of about 6,000 and is the country seat of a small but rich farming country. This courthouse cost about $185,000, and was built by Mr. Frank Milburn of Columbia, S. C., I believe. The building is of fire-resistive construction throughout, but has a bell clock-tower, constructed of **wood,** with a four ton bell supported on **unprotected steel** frame work. In addition to the lightning hazard in this tower, there is also considerable open electric work. It would be practically impossible to get to this tower with any protection, as the building is set on an elevation and the tower is probably 100 feet above the street. A small fire in the frame work of this tower would probably buckle the steel supports and release the bell, which would probably pull down the tower and dome through the rotunda and to a large extent collapse the entire building. One interesting feature about this matter is that in a case of this kind, no matter what the specifications were, **the architect gets the blame** when the defective construction is penalized in the insurance rate or when the building is destroyed through this fault.

Believing this practice of designing wooden roofs for otherwise incombustible buildings of sufficient importance to warrant the special attention of our leading architects, the matter was taken up with the fire prevention committee of our active member, the American Institute of

Architects, through our associate member, Mr. Julius Franke, chairman of that committee.

Subsequent to the consideration of the matter by the fire prevention committee of the Institute which agreed something should be done, Mr. Franke caused a bulletin to be printed in the Journal of the Institute of which the following is an extract:—

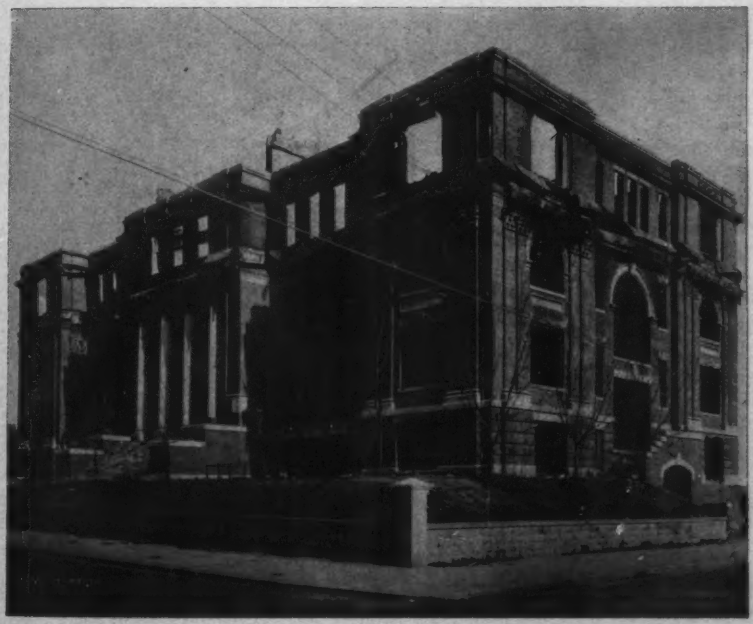
The Committee is in receipt of complaints to the effect that some schools and other public buildings have been erected fire-resistive, excepting the roofs which are of timber construction, and that total loss has occurred owing to this construction.

The committee is glad to record that the architects mentioned in connection with these particular cases are not members of the Institute.

It is a well known fact among architects, that in such matters they are seldom their own masters, as building committees and officials insist on false economy when funds are short, and it is also a well known fact that if things do go wrong, the architect is blamed.

The committee, therefore, recommends for public institutions, schools in particular, that the roof as well as the rest of the buildings be made fire resistive, and in case the architect is dealing with officials of the kind above referred to, that he draw their special attention to the public criticism directed against this particularly bad species of economy.

The members of the Association are urged to inspect the plans of all public buildings to be erected in their home communities, and exert their influence where necessary to stamp out this penny-wise and pound-foolish practice.



Hot Springs, Ark., school after the fire, showing extent of damage.

Gasoline Fires Caused by Frictional Electricity.

Several fires of mysterious origin in garages have been finally traced to ignition by a spark of static electricity generated by the friction of gasoline when it is poured into the tank of the automobile. For a long time no reason could be given for certain fires in garages, where there was good evidence that an open flame or electric wires were not a factor.

During last April a fire occurred at the Cambridge Garage of the Metropolitan Park Commission, which was carefully investigated by Mr. Walter Wedger, Chemist for the Detective and Fire Inspection Department of the Massachusetts District Police. In this instance a car was being filled with gasoline, which was poured into a funnel through a chamois skin strainer from a five-gallon can. The funnel would not sit upright in the hole of the tank, and to overcome this difficulty a wooden ring was first placed in the filler hole and the funnel set in this. In this way the wood insulated the funnel from metal of the tank. After pouring some gasoline through the chamois skin, the man brought the pouring can near to the metal edge of the funnel, and a spark jumped from the car to the funnel, igniting the gasoline vapor. The prompt use of extinguishers saved the car from serious damage. This man insisted that he heard the spark. It was then decided to try and duplicate these conditions and make several tests. A number of engineers and other interested people were invited by Mr. Wedger to witness these tests. Gasoline was poured through a chamois skin covered funnel insulated from the floor of the garage, and a spark obtained. Several experiments were tried, and a gold leaf electroscope, which was used to locate a charge of static electricity, showed it to be present in considerable quantity. The funnel, which was painted on the outside, was placed in the tank of the car without the wooden block, and the experiment repeated. The size of the charge was considerably less, and when it was again tried with the paint removed so that the funnel made a good contact with the metal of the tank, the electroscope did not show any static charge present.

Various other tests were made which convinced those present that gasoline poured through a non-conductor of electricity did generate frictional electricity, and as the chamois skin was such a non-conductor, electricity was generated by pouring the gasoline through the chamois. This in itself is not a new phenomenon, for it is an old experiment to obtain an electric spark by the friction or rubbing together of two non-conductors of electricity. Gasoline, unlike water, is a non-conductor of electricity.

If the non-conductor is in contact with the ground or a large metallic body, the amount of static electricity generated will be absorbed and does not make its presence known. However, if the non-conductor is in contact with only a small amount of metal, as a funnel or a faucet, this metal becomes highly charged with electricity and will discharge with a good-

sized spark if another metallic substance is brought in contact with it or very close to it. Consequently in this fire the funnel, being insulated by the wooden block, became charged, and when the metal pouring can was brought near it, it discharged with a spark of sufficient intensity to ignite the gasoline vapor.

Several other fires which were caused by frictional electricity have come to the attention of the Massachusetts District Police. Chemist Wedger says:—

A chauffeur in a private garage at Brookline hung a five-gallon can by the bail, on the hook of a common self-measuring pump, the bail having a wooden handle which insulated it from the metal of the pump. He had drawn about a gallon when a spark jumped from the can to the pump and set fire to the gasoline. He threw the can out of the open door, and after extinguishing the fire and desiring to fill his car, he repeated the operation with the same can with the wooden handle, and it caught fire the second time. After that the man refused to go near the pump, and went to a public garage to get his car filled.

Not long after that another chauffeur in the same town proceeded to fill his car from a pump by means of a sixteen-foot rubber hose, to the end of which was fitted a nozzle shut-off of metal. While one man was doing the pumping, the other held the nozzle near the car tank, but did not bring it in actual contact. A spark, which he describes as half an inch long, jumped to the tank and set fire to the gasoline.

Several fires have occurred recently at one of the Albany oil stations, evidently caused by the generation of frictional electricity in a canvas spout used to convey gasoline to tank cars.

The canvas was covered with a coating of shellac, and the spout hung from an overhead pipe, the lower end being in or near the manhole of a tank car, but not touching the metal of the tank.

Recent tests show that the friction of gasoline passing through this spout and rubbing against the shellac coating caused the generation of between 400 and 500 volts of electricity.

There has already been devised a special non-static hose for use on gasoline pumps. This hose has two wires imbedded in the rubber, which connect the nozzle or faucet directly with the metal coupling to the pump, consequently, any charge generated is conducted in this way to the ground.

Hose Streams on High Tension Wires.*

The experiments showing the actual voltage to ground obtained at the nozzle of a fire hose were made under the supervision of the office of the General Superintendent of Motive Power of the Pennsylvania Railroad Company at Altoona, Pa., and are presented by permission of the Pennsylvania Railroad. The tests showing the resistance to ground were made by Messrs. Allan Bond and O. G. Galland at the Ohio State University under the direction of Professor F. C. Caldwell; the results of these tests were originally published in the *Sibley Journal of Engineering*.

Experiments with Fire Streams at Altoona.

In order to determine definitely what hazards, if any, exist for firemen when they are compelled, in line of duty, to play water from fire streams on line wires at various potentials, arrangements were made so that circuits of 525, 2,300 and 4,600 volts, respectively, were available. The

*Courtesy of *The Electric Journal*.

525 volt line was a direct-current trolley wire connected to the trolley of the Altoona & Logan Valley Electric Railway Company. The 2,300 and 4,600 volt lines were fed from alternating-current generators at the Altoona Car Shops. One side of each of these circuits was thoroughly grounded and the fire stream was played on the other side, which was suspended in the air and thoroughly insulated. A suitable voltmeter was connected between the nozzle and ground to enable the difference of potential between the nozzle and ground to be noted in each case.

The results given in Table I were obtained in tests made the day previous to the general demonstration. These results show that the nozzle may be handled without discomfort up to a point between three and four feet from the wire when those handling the nozzle are standing on the ground. It may be carried much nearer without harm but would probably cause discomfort. If those holding the nozzle were standing on a wooden ladder or were otherwise insulated from the ground, it would be quite safe to bring the nozzle to within a few inches of the wire. In each of the tests indicated in Table I, at 2,050 and 4,100 volts, no measurable deflection could be obtained on the voltmeter, but upon touching the nozzle with the hand, when standing on the ground, a slight effect due to the static electricity was noted.

In the demonstration held on the succeeding day, results were obtained

TABLE I.—VOLTAGE TO GROUND FROM A FIVE EIGHTHS INCH NOZZLE

Voltage on Wire	Distance from Nozzle to Wire	Volts between Nozzle and Ground
525	7 ft. 5 in.	20
525	4 ft. 9 in.	38
525	3 ft. 7½ in.	60
525	2 ft. 2 in.	70
525	0 ft. 7½ in.	210
2050	6 ft. 6½ in.	Static
2050	3 ft. 5½ in.	Static
4100	6 ft. 6½ in.	Static
4100	3 ft. 5½ in.	Static

TABLE II.—RESULTS OF DEMONSTRATION AT ALTOONA

Size Nozzle	Voltage on Wire	Distance from Nozzle to Wire. Feet	Volts between Nozzle and Ground
⅝ in.	525	3	Slight indications of static electricity to the hand
1 in.	2300	8	Slight indications of static electricity to the hand
1 in.	4600	10	Slight indications of static electricity to the hand

which agree with those shown in Table II. In each case the nozzle was sufficiently near the wire to cause a solid stream to play on the latter. Just how far the results of a fire hose test with salt water will differ from the above, which were made with fresh water, cannot be said at the present time.

Experiments were also made with streams from hand chemical extinguishers, and it was found that when a solid stream is played on a high potential wire it becomes a source of danger to the one holding the extinguisher. For instance, the nozzle of an extinguisher was held at a distance of nine inches from a grounded 2,050 volt alternating current line. The difference of potential between the nozzle and ground was 1,500 volts when the extinguisher was insulated from the ground.

The Resistance of a Stream of Water.

These tests were made to represent actual conditions as nearly as possible by using regular fire hose and nozzles, the latter of the sizes most used, one and one eighth and one and one half inches in diameter, the dimensions of the nozzles being given in Fig. 1. The water used was from the condensing tank of the University power plant. It had been softened by the use of soda and lime and probably would have shown a somewhat lower resistivity than average city water. This, however, as will appear later, would not affect the more important deductions made herein.

The investigation took the form of measurements of the resistance of the stream of water between the hose nozzle which was grounded and a twelve-foot piece of No. 6 copper wire, strung horizontally ten feet above the ground. The voltage was obtained from one terminal of a 250,000 volt, 50 kilowatt transformer. The middle point of the high tension winding was connected through a low reading ammeter to earth; one terminal was connected to the wire while the other terminal was open. The required value of the voltage was obtained by the proper excitation of the primary and its value determined by a voltmeter on the primary and the transformation ratio of the transformer. Variation of the frequency between 60 and 45 cycles with 20,000 volts impressed upon a six-foot stream of water showed that there was no appreciable reactance. The resistance was thus calculated from the current and applied voltage.

The voltage, water pressure and length of stream between the nozzle and the wire were varied and the effect of each upon the resistance was studied. Variation of voltage produced no well defined effect upon the resistance within a range between 5,000 and 30,000 volts. In this test water pressures from 30 to 70 pounds were used and a stream length from 6 to 15 feet.

Increase of water pressure gave increased resistance. This was slight for six and ten foot stream lengths, but quite marked for fifteen feet. It appears that with the higher pressures the stream is less solid, especially at a greater distance from the nozzle.

The really striking and interesting results obtained from the tests however, came with the variation of length of stream. The results with the one and one eighth inch nozzle are shown in Figs. 2 and 3 for 5,000 and 30,000 volts, respectively, and for different pressures. With 20,000 volts the curves are practically the same as those shown for 30,000 volts. Fig. 4 gives similar curves for the one and one half inch nozzle. In all

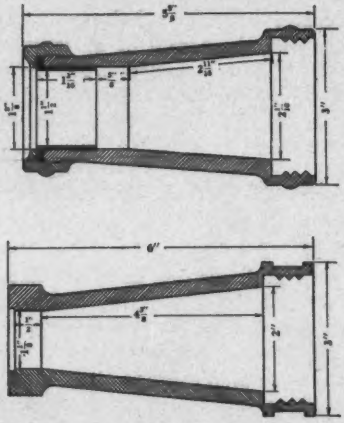


Fig. 1. Sections of Nozzles used in Tests, Showing Dimensions and Types of Orifices.

these curves the resistance increases gradually up to a critical length which for the one and one eighth inch nozzle is about 17 feet, and for the

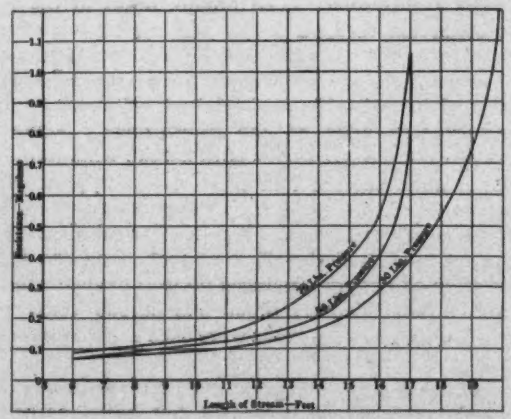


Fig 2. Curves of Resistance.

With varying stream lengths from a one and one-eighth inch nozzle, directed onto a 5,000 volt line.

one and one half inch nozzle 20 feet. Beyond this point the resistance rises suddenly and approaches rapidly to infinity. This critical length is nearly independent of the pressure used, though becoming slightly lower for higher pressures. Observation of the stream of water makes the cause of this critical length clear. It is the point where the stream ceases to be continuous and breaks up into a mass of separate water drops.

As to the bearing of these results, it may be noted that a current of 0.02 amperes is quite painful to most persons and that 0.05 amperes is at or beyond the limit of endurance. While the minimum fatal current is very uncertain, it is probable that it would very seldom be less than 0.1 ampere and usually much more. If a stream length of fifteen feet and 50,000 volts are taken as an example, the curves show that for a one and one eighth inch nozzle a resistance of about 20,000 ohms would be obtained and hence a current of about 0.25 amperes. Such a current

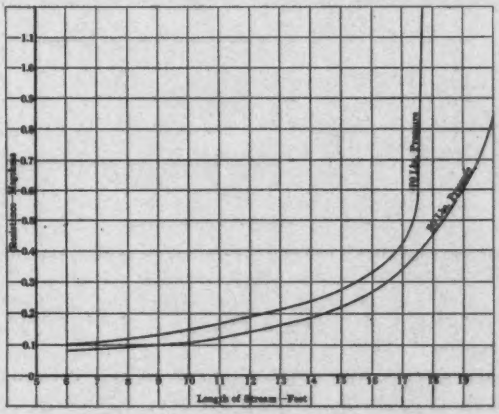


Fig. 3. Curves of Resistance.

With varying stream length from a one and one-eighth inch nozzle, with stream directed onto a 30,000 volt line.

would certainly give a severe shock and in some cases would be dangerous. If, however, a stream length of 20 feet is assumed for a one and one-eighth inch nozzle, or 25 feet for a one and one-half inch nozzle, the resistance would be 800,000 ohms or more, which for 50,000 volts would give but 0.06 amperes or less, which, while painful, would practically never be dangerous to life. In these calculations the resistance of the body, being only a few thousand ohms, has been neglected.

Since high tension circuits should always, when near buildings, be carried on poles that would bring the lines much more than 25 feet from the ground, it would seem that little fear of injury to firemen from this source need be entertained so long as the poles are of proper height and

the fireman is working from the ground. If, however, he is working from a metal ladder, or is using a tower which would bring the nozzle

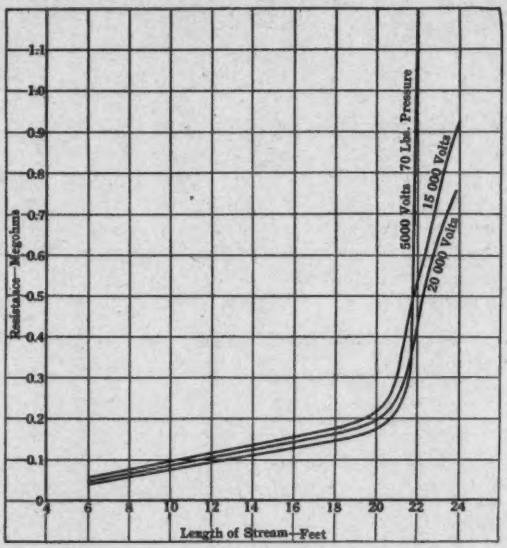


Fig. 4. Resistance Curves.

For various voltages with a one and one-half inch nozzle, and 70 pounds water pressure.

into close proximity to the wire, a dangerous shock might be received through the stream.

It may be asked whether the fact that the nozzle is grounded through the stream of water in the hose would not keep its voltage so near that of the earth that even with the short stream length there would be no danger. With this point in mind the resistance of the path from nozzle to ground through the water in the hose was investigated when the latter was thoroughly insulated from the ground and found to be about 150,000 ohms per hundred feet, from which it would appear that such a ground connection could not be depended upon to shunt much of the current around the man holding the nozzle.

Fire Department Civil Service Examinations.

The municipal civil service commission of the city of New York was recently called upon to conduct an examination of over two hundred fire department captains competing for promotion to the office of battalion chief, and of some thirty battalion chiefs competing for the office of deputy chief.

As there is probably no city in the world which presents more complicated problems in fire fighting than the American metropolis it may be easily imagined that the task of selecting the men upon whom executive functions may fall during fires is not to be lightly undertaken.

It is a common criticism uttered by the opponents of civil service in fire departments that while examinations in respect to knowledge of laws and ordinances, department rules and regulations, and report forms may be effectively conducted, examinations in administration cannot be significant or effective because every fire which actually calls for head work or judgment presents problems not encountered in any other.

It is obvious, however, that a fireman who exhibits good judgment in one emergency may reasonably be expected to keep his head in another. While it is generally true that for some it is easier to work out an administration problem calmly, on paper, than in the smoke and confusion of fire, it is equally true that to others the latter is the less formidable task. Paper and ink have sometimes baffled first-rate men.

It was quite generally conceded that at the recent examinations in New York City the men who were expected to answer the questions put to them—particularly in the administration section—in a certain limited period of time, labored under more excitement than any ordinary fire experience would have engendered. Captains do not have the opportunity to become battalion chiefs, nor battalion chiefs deputy chiefs every day.

In this examination a total of credits or "weights" of 10 was established; administration counting 6, laws and ordinances 1, rules and regulations 1, and report 2. The commission realized that for an executive the item of administration was paramount, and sought to obtain a list of questions that should tax the imagination and the capacity of the competitors. Under the rules the commission is not authorized to employ any person for the preparation of these papers who is serving in any of the departments of the city government, and for obvious reasons it was considered inadvisable to engage former members of the fire department in this capacity. In previous years Mr. W. E. Mallalieu, General Manager of the National Board of Fire Underwriters, had rendered this important

service, which when undertaken in the serious spirit which Mr. Mallalieu brings to all his tasks means long and painstaking deliberation and labor. Feeling unequal to the task because of the many recently added responsibilities of his present office, Mr. Mallalieu suggested for this year's service another devoted member of the N. F. P. A., Mr. Charles H. Fischer of Newark, and it is through Mr. Fischer's courtesy that his fellow members of the Association are able to study in this issue of the QUARTERLY the problems of administration evolved in his fertile brain.

The Chief of the New York Fire Department declared that the administration examination for deputy chief was the most severe in the history of the department. All of the weekly papers which commonly notice fire department doings emphasized the originality, aptness and severity of Mr. Fischer's questions, and the civil service commission itself believed the practical application of the items beyond dispute.

We present herewith the full text of the examination papers, which include beside Mr. Fischer's contribution the questions on laws and ordinances, rules and regulations and reports.

SECTION A.

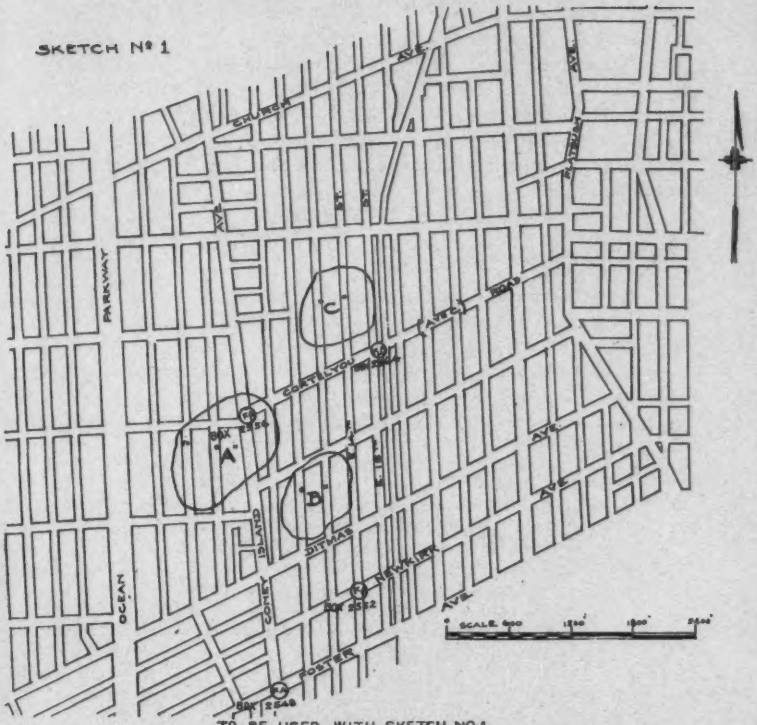
EXAMINATION OF CAPTAINS FOR THE OFFICE OF BATTALION CHIEF.

Administration. (Weight 6.)

1. In Sketch No. 1 is shown a section of Brooklyn which is built up mostly with two and three story frame, shingle roof dwellings and apartment houses, with some scattered groups of two and three story brick, metal roof dwellings and apartment houses; in two locations in this section there are small mercantile districts. For about one mile on each side of the section shown in the sketch the construction is practically the same. The streets range from 60 to 80 feet in width.

   The deputy chief of the division in which your battalion is located is away on leave and you are in charge. You are absent from your quarters, inspecting the companies in the division you have charge of. It is summer and very dry. There is a twenty mile wind blowing from the southwest. On your arrival at one of the company quarters in this division you receive word by telephone that a third alarm has been sent in from box 2548 for a fire in a four story and basement, joisted brick cork factory and a two story frame wood working plant with a large lumber yard; all adjoining and exposing one another. You are also advised that flying brands are going into the air and appear to be carried long distances by the wind and it is reported that several dwellings have started in each of the locations, "A," "B" and "C" shown in the sketch. Assume that it is your duty to handle the entire situation.

   What would you do and give the order in which you would do it?



STATIONS	ENGINE COMPANIES			H.&L.COS.		COMPANIES TO SUPPLY FROM FUEL DEPOT				COMPANIES TO CHANGE LOCATION ENGINE COMPANIES						H.&L. COS	
BOX 2548	250	281	255	147	—												
CONEY ISLAND AND FOSTER AVES.	147	240	248	255	—	E 150	E 250	E 150	E 250								
	176	247	249	148	—	E 155	E 281	E 150	E 281	220-240	255-280	270-282					
		282	276	—	—	E 140	E 255	E 156	E 250	228-140	135-149	142-145				145-150	
BOX 2552	281	250	255	147	255												
14TH ST. AND NEW KIRK AVE.	248	240	—	—	—	E 150	E 281	E 150	E 281								
	249	247	—	148	—	E 155	E 250	E 155	E 250	276-228	255-295	278-282					
	282	220	—	—	—	E 148	E 255	E 150	E 250	135-149	145-150					140-155	141-140
BOX 2556	281	250	240	147	255												
CONEY ISLAND AND AVENUE C	248	255	—	—	—	E 281	E 150	E 281	E 150								
	249	282	—	148	—	E 140	E 250	E 140	E 250	276-258	255-285	278-282					
	247	220	—	—	—	E 148	E 240	E 150	E 250	135-149	145-150					141-140	
BOX 2564	281	250	248	147	255												
E. 15TH ST. AND AVENUE C	255	240	—	—	—	E 150	E 281	E 150	E 281								
	249	247	—	148	—	E 148	E 250	E 148	E 250	228-240	278-282	255-249					
	282	220	—	—	—	E 155	E 248	E 150	E 250	148-140	153-145					140-155	145-150

2. A fire occurs on the forty-second floor of an office building having an 8-inch standpipe with a 2½-inch hose connection on each floor and a siamese steamer connection outside of the building. A low pressure hydrant capable of supplying 800 gallons per minute at ten pounds

pressure and a high pressure hydrant are 150 feet from the siamese connection. You require 1⅛-inch and one 1¼-inch nozzles on the forty-second floor. The 1⅛-inch nozzle is supplied from the forty-third floor and the 1¼-inch nozzle is supplied from the forty-first floor. Each line has 100 feet of 2½-inch hose. Assume that you carry 40 pounds pressure on the 1¼-inch nozzle and that you require 200 feet of hose to reach from either hydrant to the siamese connection.

(*a*) How much water will you discharge through the 1¼-inch nozzle?
(*b*) What pressure will you have on the 1⅛-inch nozzle?
(*c*) What pressure would you carry at the engines or at the high pressure hydrant?
(*d*) How would you supply the standpipe, and if you use engines what size engines would you use and how would you use them?

3. A standard automatic sprinkler equipment is installed in each of the following buildings:—

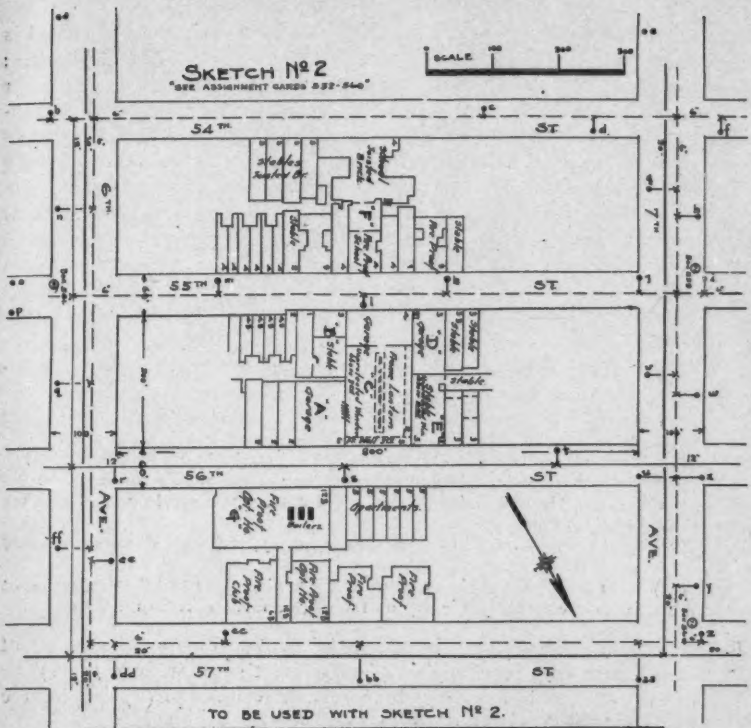
(1) Wholesale drug house carrying a large stock of paints, oils, acids and ammonia in the basement; mill constructed floors; walls brick; open ceilings; five stories and basement in height; area, 8,000 square feet; elevator and stair open.
(2) Dry goods warehouse with goods in cases; ordinary joisted floors; walls brick; open ceilings; six stories and basement in height; area 10,000 square feet; elevator and stair in brick enclosure.
(3) Cooperage plant with barrel storage; ordinary joisted floors; walls brick; ceilings part open and part wood sheathed two stories in height; area 30,000 square feet; barrel conveyors, stairs and elevators open.

(*a*) In which building do you consider the sprinkler equipment would be most efficient and most reliable, and why?
(*b*) In which building do you consider the sprinkler equipment would be least efficient and least reliable, and why?

4. What would be your procedure if called and in command under the following conditions?

(*a*) A burst steam pipe in the engine room of a large factory;
(*b*) A badly leaking ammonia pipe in a refrigerating plant;
(*c*) A building collapsed due to adjacent excavation.
(*d*) What is the danger from shafts and how should it be met in fire fighting?
(*e*) What precautions in construction are desirable?
(*f*) What inspections of shafts in the line of fire prevention are desirable?

5. In Sketch No. 2 the five buildings marked "A," "B," "C," "D" and "E" are three to five story, ordinary joisted brick structures, each has unprotected elevator and stair openings on all floors. In buildings "A" and "E" there are unprotected window openings above the third floor overlooking the roof of building "C." Building "C" has a large frame lantern extending practically the entire length of the roof. The floors in buildings "A" and "E" are supported by unprotected cast iron columns. Buildings "A," "C" and "D" are occupied as garages with automobile storage on each floor; buildings "B" and "E" are occupied as livery and boarding stables



TO BE USED WITH SKETCH Nº 2.

STATIONS	ENGINE COMPANIES.						H. L. COS	W.T.	TO SUPPLY PUB.	FROM PUB.	COMPANIES TO CHANGE LOCATION		
											ENGINE COMPANIES		H. L. COS.
Box 552	23	2	54				35	4					
10TH AVE. AND 55TH ST.	40	34	74	65			21		3	W-5-4	27			
	26	8	56	19	30		25			W-8-11	27	38-23		
	1	21	3	44	14	16	2			W 9	27	31-14	13-1	
	76	18	5	24	25	30	24							
Box 560	23	54	40				4	35						
7TH AVE. AND 57TH ST.	8	65	26	39			2		3	W-5-4	15			
	2	74	1	21	34		24			W-11-8	15	18-23	5-1	21-4
	56	44	19	14	16	76	25			W 9	15	33-14		

with the stabling of horses in the basement and on the second and third floors. Building "F" across the 60-foot street from building "C" is a part joisted brick and part fireproof public school, four stories and basement in height. Building "G" across the 60-foot street from building "A" is a twelve story and basement fireproof apartment house. The other buildings in the immediate vicinity are as shown on Sketch No. 2.

The chief of the fire department is on an extended leave of absence and the acting chief is in Tottenville inspecting a fire department house. You are acting deputy chief and in charge. You are at a

third alarm fire at box 552 at 10.30 in the morning, when school is in session. An automobile on the first floor of building "C" ignites; the gasoline tank explodes, throwing burning gasoline over a number of other automobiles which take fire and their tanks explode, spreading the fire over practically all of the first floor. An alarm is turned in from box 560, followed immediately by a telephone alarm giving the exact location of the fire. You are notified of this at once. On account of the close proximity of the school and in consideration of the fact that you have just succeeded in getting the first fire under control you decide to respond to the second fire. You arrive immediately after the first alarm companies and find that not only the entire first floor of building "C" is involved but that the fire has already spread to the second and third floors and through the frame lantern seriously endangering the unprotected windows in the walls of buildings "A" and "E."

(*a*) State the commands you would give and the order in which you would give them.
(*b*) What additional apparatus would you call and why would you call it?
(*c*) What apparatus would you expect to find at the fire on your arrival?
(*d*) Using the letters designating the hydrants, where would you locate the engines you summon?
(*e*) What size and length of lines would you lay, and what size nozzles would you use?
(*f*) What pressure would you carry on the engine closest to the fire, and what pressure would you carry on the engine farthest from the fire?

6. What features in each of the classes of occupancy given below are of importance and require special consideration as relates to (1) the control of fires in buildings having such occupancy, (2) keeping the loss resulting from fire down to a minimum.

(*a*) Art galleries.
(*b*) Breweries.
(*c*) Lime Storage.
(*d*) Electric light and power station.

7. A fire is in progress in a four-story brick building where chemicals are manufactured. The windows in the building are fitted with iron shutters throughout, and it operates under permits of the Bureau of Fire Prevention. You are aware that there are several electrically driven stirring and evaporating centrifugals on the two upper floors and that the lighting installation comprises both gas and electricity. You are aware that the cellar contains carboys of sulphuric and nitric acid, and stored bromine in steel cylinders. And you are informed that several screw-cap flagons of bromine and syphon flasks of sulphur dioxide are probably ready for daily use on the second or third floor.

The building is in the high pressure district, and in a thickly populated neighborhood where many of the surrounding tenements are of five and six stories.

(*a*) State fully what preliminary precautions you would take.
(*b*) At what part of the building you would effect entrance.
(*c*) Outline your general plan of attack and give reasons for what you would do.

8. A block 800 x 200 is bounded on the north by 2d St.; on the south by 1st St.; on the west by Ave. A, and on the east by Ave. B. Ave. A is 1,000 feet from the bulkhead line and 1st St. is 800 feet from a navigable creek. It is in a factory district. The block is traversed by a siding from the railroad yards between the creek and 1st St.

A fire breaks out in a 7-story drug warehouse on Ave. A and is noticed at 7 a. m. by dense smoke coming out of the windows; soon the holes in the shutters show flames. The wind threatens from the west to spread the fire to a paper house and, across the street, a varnish factory. The latter has automatic sprinklers. To the east of the drug building are a bag factory and rug factory. Further east are also various low buildings with more or less inflammable material. Six-inch mains on Ave. B and 2d St., elsewhere 12-inch mains.

As battalion chief you arrive on second alarm, finding the kettle room of the varnish factory has also caught fire.

State, in order of procedure, what action you take, what orders are given, and how you distribute your companies.

Laws and Ordinances. (Weight 1.)

1. You observe the following at fires at which you are present:
(*a*) State in each case whether the condition is a violation of the law.
(*b*) Give the essential provisions of the law governing each case.

1. A manufacturer of mattresses is storing excelsior on the top floor of his factory in a room which is 25 x 100. It is piled from the floor to within three feet of the ceiling which is nine feet from the floor.
2. A paint store on the ground floor of a tenement house has self-closing fireproof doors, a transom glazed with wire glass, and the windows between the store and the hall glazed with extra thick French plate glass.
3. A very large main entrance in a theatre serves as a means of entrance and of exit for the main floor and the first and second galleries.
4. There is nitroglycerine in a retail drug store.
5. There is a bakeshop in the basement of a tenement house, and a bakery store on the ground floor with a dumb-waiter from the basement through the store to the upper floors of the house.
6. There are 100 reels of moving picture films in the storage room of a moving picture theatre.
7. In an elevator apartment house the elevator doors are not self-closing and the dumb-waiter shaft which is situated in the well of the stairs is not fireproof.

2. Give a detailed account of the circumstances under which the fire commissioner is authorized and empowered to cause the removal of a ship from one part of New York Harbor to another.

3. During a great conflagration, it becomes necessary to pull down a certain building in order to prevent the spread of the fire. Under such conditions

(*a*) Name the official who orders the destruction of the house.
(*b*) Describe how the work of destruction is actually accomplished.
(*c*) Explain the precautions that must be taken in executing the work of destruction.
(*d*) State how the owner of the property destroyed is compensated for his loss.

4. What are the important provisions of the law regarding
(*a*) Storage of boxes and barrels in vacant lots.
Storage of baled hay and of unbaled hay.
Fireproof construction of interior floor lights.
Keeping, selling and transporting calcium carbide.
(*b*) How must inflammable moving picture films be stored?
Under what circumstances should they be examined, repaired and pieced when in storage? How are such storage rooms to be lighted? How furnished and specially equipped?

5. In a contemplated hotel structure, to be 12 stories high, what protection from fire will be required?

N. B.—In your answer consider the passing of plans, material to be used, fire appliances to be installed, fire escapes, inspections, etc.

Rules and Regulations. (Weight 1.)

1. You are in command at a fire which has partially consumed a building wherein were located a large clothing manufacturing business on upper floors, a furniture salesroom on ground floor, and a printing establishment in basement.
The fire seems to be subdued. Explain carefully the particular matters you would look to, before ordering the men to quarters and leaving the scene of the fire.

2. (*a*) What are the duties of battalion chief:—
(1) at a fire
(2) at company quarters
(3) in cases of false alarms
(4) regarding reports of fires
(5) regarding animals burned?
(*b*) Enumerate all of the reports which a battalion chief is required by the rules of the department to send to headquarters by telephone.

3. State clearly all of the action you are required to take by the rules of the department under the following circumstances. You respond as chief of battalion first due at Station 789. You are informed by the captain of Engine 53 upon his arrival that while driving along Third Avenue he noticed a large water main broken and the water spouting high into the air. The lieutenant in command of Engine 58 reports the illness of one of his men while responding to the fire and states that he has sent him to the hospital. The fire is in an old stable containing about fifty horses; these are being driven out of the building

by policemen. You learn upon your arrival that the fire has spread to the old-law tenement on each side of the burning stable and that several horses have been burned to death in their stalls.

4. (*a*) What are the provisions of the rules relative to applications for transfer? As battalion chief, what general considerations would guide you in approving such applications?
(*b*) Under what conditions and restrictions may leaves of absence be granted at the discretion of battalion chiefs and commanding officers?

5. (*a*) Explain how "double companies" are composed, and give an account of how such companies should be handled so as to produce the most satisfactory results in the performance of their duty.
(*b*) Describe the manner in which fire apparatus should be handled (before and after use) when it becomes necessary to take water from the East River for use at a fire.

Report. (Weight 2.)

Write a report of about 300 words giving from your own knowledge or experience reasons in favor or against the proposed repeal of the ordinance which makes it necessary for garage owners to prevent oil from flowing into the sewers.

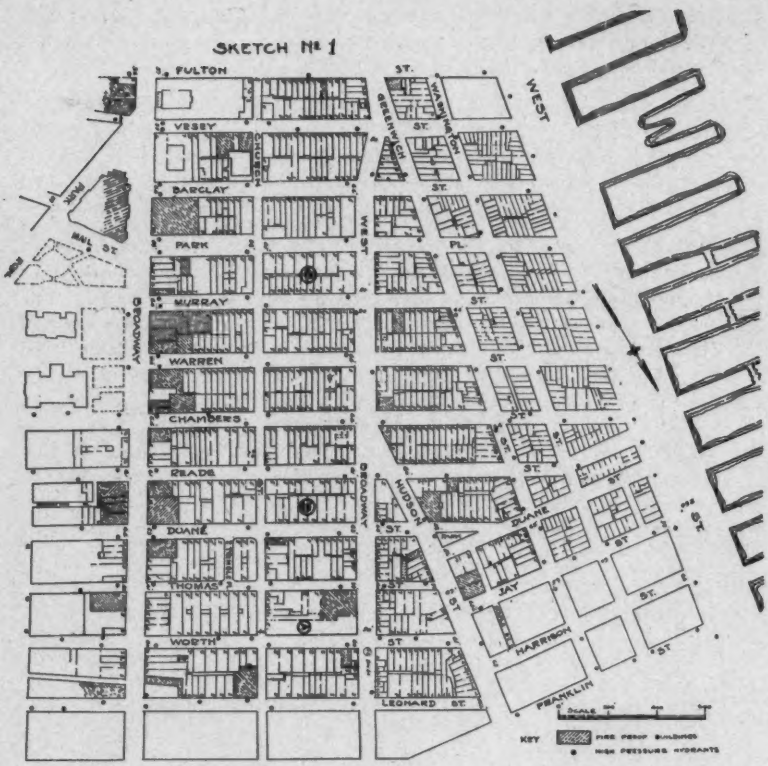
SECTION B.

EXAMINATION OF BATTALION CHIEFS FOR THE OFFICE OF DEPUTY CHIEF.

Administration. (Weight 6.)

1. Sketch No. 1 shows a small section of Manhattan known as the Dry Goods District. The height of all the buildings, the widths of the streets and fireproof buildings are indicated on the sketch. The type of construction, except where fireproof construction is shown, is joisted brick or stone with numerous cast iron fronts. In all blocks, except those where the buildings run through from street to street, there is one or more open courts in the center of the block. The window openings facing these courts are generally protected with thin sheet iron shutters. In a number of blocks there are non-standard and thin glass skylights over the one-story projection into these courts.

The building marked "A" on Worth Street in the sketch is an old five-story basement and sub-basement ordinary joisted brick structure with stone front on two streets, occupied as a wholesale dry goods house; area is 31,000 square feet; floors are light construction supported by cast iron and wood columns. The stairs are open on all floors and the elevators are in wood enclosures. This building communicates with the other buildings in the block through unprotected or poorly protected openings and by bridges. There is a light court in the center of the block. Each building in the block is protected



TO BE USED WITH SKETCH NO 1

STATION	ENGINE COMPANIES							HDL CO'S	W T	TO SUPPLY ENG.				FIRST ALM	CONNECTIONS TO CISTERN				SUCTIONS	
															ENGINE	COMPANIES			HDL CO'S	
BOX 261	30	24	13	18				20	6											
MICDOUGAL AND	33	26	72	55				9		2	11	2	3	6						
BLEECKER STREETS	35	27	10	5	31			6			11	1	6	5	26-10					
	3	17	7	28	9			3			11	11		6	15-12				11-3	
BOX 84	27	7	29	31	12			8	1	1										
WEST BROADWAY	30	13	9	6	28			10			12	1	2	3						
AND WORTH STREETS	32	35	4	24	33			20			12	3	6	3	16-23				5-1	
	17	15	72	25	11			6			12	11		3	8-15					
	10	28	3	19	14	1		19							26-16	30-1				

by a wet-pipe system of automatic sprinklers. On account of a failure in the heating plant the sprinkler pipes become frozen. The chief of the department is out of the city and you are in charge. It is winter. Snow has fallen to the depth of twelve inches. The temperature is five above zero. There is a thirty-five mile wind blowing from the northeast. You are at a fourth alarm fire at box 261 where you are using 15,000 gallons per minute from the high pressure system. While you are at this fourth alarm fire, at 6 in the

morning, a fire starts in the sub-basement of building "A" near the wood enclosed elevator shafts. It burns through the wood enclosure and goes up the shaft. The watchman discovers fire on his round on the fourth floor. He runs to Box 84 and pulls it. After waiting three minutes the apparatus fails to arrive. He rushes back to the building and notifies headquarters by telephone of the fire. The usual still alarm response is sent out. In the meantime the attendants at fire alarm headquarters discover that one of the fire alarm cables, exposed to high tension light and power cables, has gone out of commission and cut practically all of the fire alarm boxes in that part of the city out of service. The captain of the first of the still alarm companies finds that the fire has already spread to all floors and goes to Box 84 to summon additional apparatus. The captain discovers immediately that the box is out of service and goes to a telephone. Fire alarm headquarters notifies him of the accident to the fire alarm cable and immediately sends additional apparatus. You are notified and you respond at once. On your arrival you find that the whole of the Worth Street side of building "A" is burning on all floors; the fire has already jumped across Church Street and is coming out of the buildings facing Thomas Street. You take such action as you consider necessary and after ten minutes receive word that two fires have started; one in the center of the block bounded by Church, Reade, West Broadway and Duane marked "B," and the other in the center of the block bounded by West Broadway, Murray, Church and Park Place, marked "C."

(*a*) What would you do immediately on your arrival at Box 84?
(*b*) What would you do when you were notified of the two new fires starting in locations "B" and "C," and how would you handle the entire situation?

2. (*a*) State the specific features essential for an efficient fireboat
(1) as to its hull construction
(2) as to its power equipment
(3) as to its fire fighting equipment on deck.
(*b*) State the relative advantages and disadvantages of aerial and plain ladder trucks; of spring, pneumatic and hydraulic towers.
(*c*) What is your opinion of the advisability of equipping ladder trucks with ladder pipes with nozzles permanently attached?

Why not have 120-foot ladders, as used in London, with our present trucks? Or, how would you provide suitable trucks for them? State both sides of the case.

Would it be more satisfactory, or advantageous, to make our 75-foot ladders in three sections instead of two with the present trucks?

3. The fire commissioner has decided to institute an investigation to determine whether or not it is possible (1) to reduce the fire losses; (2) to reduce the danger to the lives of the occupants of buildings

and members of the fire department; (3) to reduce the probabilities of a conflagration in New York City.

You are called upon to submit a complete report showing what improvements should be made and why improvements should be made.

(*a*) In the equipment and apparatus of the fire department.
(*b*) In the organization and manual strength of the fire department.
(*c*) In other departments of the city government.

4. (*a*) So far as automobile apparatus is concerned what do you consider to be the advantages and disadvantages of

(1) Motor propelled steam fire engine with individual tractor, used in connection with automobile hose wagon having chemical tank.

(2) Automobile hose wagon drawing a steam fire engine by means of a draw bar.

(3) Automobile pumping engine and hose wagon with pump driven by the same engine used for driving the car; used in connection with automobile hose wagon having chemical tank.

(4) Automobile pumping engine, hose wagon and chemical tank with pump driven by the same engine used for driving the car.

(*b*) What are the advantages and disadvantages of the following types of pumps, considering each to be driven by the motor of a gasoline engine?

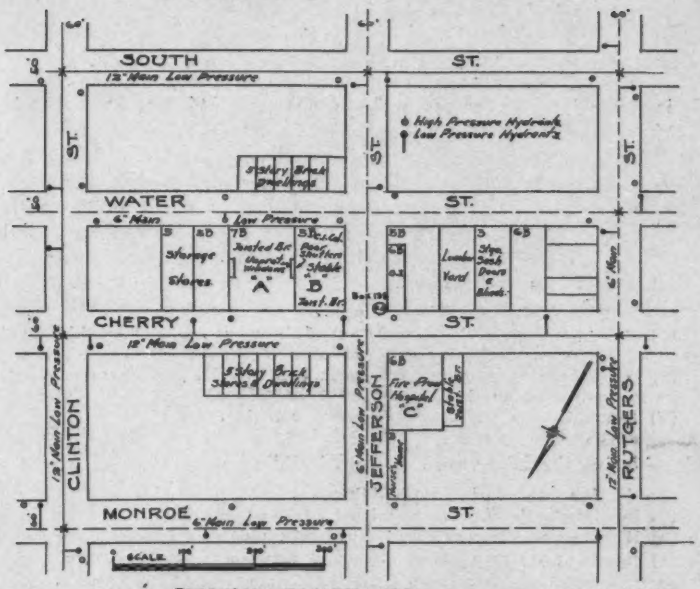
(1) Reciprocating piston pumps
(2) Rotary pumps
(3) Centrifugal pumps.

5. In Sketch No. 3 building "A" is a seven story and basement joisted brick building of about 12,000 square feet floor area; floors are one inch thick except first floor 3 inches thick, walls are light on the three upper floors; elevators and stairs in 8-inch brick enclosure with non-standard panel doors; there is also a large frame enclosed runway extending from the basement to the first floor. The occupancy is as follows: Basement—stable with 75 horses, storage of four tons of hay; 1st floor—livery and boarding stable and junk shop; 2d, 3d, 4th, 5th, 6th and 7th floors—clothing manufacturing with several tenants on a floor.

Building "B" adjoining building "A" is a five-story and part basement, joisted brick building, area 9,000 square feet. Floors double thickness, supported by cast-iron columns. Floor openings, all floors including runway for horses unprotected or poorly protected. Windows in the west wall of this building protected by poor shutters across a court six feet wide from unprotected windows in building "A." Occupied as a boarding and exchange stable with 50 horses on second and 90 horses each on third and fourth floors; fifth floor used for feed including 12 tons of hay.

Building "C" is diagonally across the street from building "B."

SKETCH No 3



TO BE USED WITH SKETCH NO.3

STATION	ENGINE COMPANIES							H&L CO'S		S T	W T	TO SUPPLY FUEL			FROM BOX NO.	COMPANIES TO CHANGE LOCATION					
																ENGINE	COMPANIES			H & L CO'S	
BOX 138 CHERRY AND JEFFERSON STREETS	15	9	17	66	77			6	18												
	12	7	55	31	132			1		1	1	W	3	1	4						
	32	41	4	25	20			9				W	2	11	4	16-55	5-17			8-1	
	29	27	6	33	13	28		11				W	6		4	10-6					
BOX 277 LEWIS AND FOURTH STREETS	11	28	25	66	132			11	18												
	15	17	33	5	77			9		2	2	W	3	2	9						
	58	9	16	31				20				W	1	11	9	16-17					
	30	24	7	14	29			6				W	8		9	26-14					
	32	4	1	21	3	19		3								54-1				5-3	

It is a 6 story and basement fireproof hospital with unprotected window openings on Jefferson and Cherry Streets. The nature of the construction and occupancy of the other buildings in the immediate vicinity are as shown in the sketch. You are at a fourth alarm fire at Box 277. A 15 mile wind is blowing from the southeast. While you are at this fourth alarm fire, at 3.30 in the morning, a fire breaks out on the first floor in the rags in the junk shop in building "A." The fire has gained considerable headway on the first floor when it is discovered by a citizen who rushes to Box 138 and pulls it. The captain of one of the first alarm companies sees at a glance that the fire has gained large proportions and sends in a second alarm. You are notified and you respond; on your arrival at the

fire you find that all floors of building "A" from the first to the sixth are burning very briskly, and that the fire has already entered the fifth floor of building "B."

State what you would do and the order in which you would do it.

6. It is desired to use across a 60-foot street a 1½-inch stream and a 1¾-inch stream from a building having a six-inch standpipe located so that it will require 100-foot hose lines to reach each window. One stream is to be located on the eighth floor and the other stream is to be located on the tenth floor. The streams are to be supplied from steam fire engines. Assume that any of the hydrants you might use are 150 feet from the standpipe and each with a supply of 700 gallons per minute at 12 pounds.

(*a*) What equipment would you require?
(*b*) On which floor would you locate the 1½-inch nozzle, and on which would you locate the 1¾-inch nozzle?
(*c*) What pressure would you carry at each nozzle, and how much water would each nozzle discharge?
(*d*) Determine the pressure required at the engine.

7. Considering the following classes of buildings

(1) Continuous row of frame buildings
(2) Public schools of ordinary joisted brick construction
(3) High loft buildings of fireproof construction
(4) Hotels of ordinary joisted brick construction.

What features of building construction do you consider of prime importance from the following standpoint?

(*a*) Reducing the spread of fire
(*b*) Making the building safer for the occupants in time of fire
(*c*) Making the buildings safer to the fire department when fighting fires in such buildings.

8. With the following details in a very destructive fire, state how you would have fought this fire (if differently from that indicated). State what serious defects in the construction are responsible for the loss. How could this fire have spread so rapidly?

An 8-story building "B" built in 1900, used for storage, and an adjoining 5-story building "A" were connected by openings protected by non-standard swinging tin-clad doors overlapping 1½ inch and not self-closing. In the rear of building "A" is a large freight elevator, alongside of the party wall, encased in an iron-clad frame shaft built to the top through its roof and extending outside to the top of building "B," and opening to all the floors therein with swinging 2-inch non-automatic tin-clad fireproof doors with iron cross bar latched in place by a lift through a ¼-inch hole.

Building "B" is "fireproof" 35 x 90 feet steel frame with brick walls, front and rear, 16 inches, and heavy side walls 20 to 12 inches. The floor steel beams are spaced 8 feet apart with arches of old style white plaster fireproofing, light wire mesh, shavings and sand, and there is a facing on floor and ceiling of adamant cement, 1½ inches.

Open stairway in rear of "B" opens freely to all floors. Elevator near the

front against the side wall is enclosed on 1st floor by corrugated metal; on second by plaster block partitions; on top floor open grille work; on 3d, 4th, 5th, 6th and 7th by adamant cement over plaster 2-inch blocks with open grille doors.

Furniture, pianos, and all manner of inflammable material were packed on all floors right up to the party wall, in both buildings.

All floors were open spaces except that 3d and 4th had each 10 storage sections on each side of a central aisle from front to rear.

Fire was noticed at 12.29 p. m. in the wire box of the telephone system where it had come in contact with a high tension power wire on the ceiling of the 2d floor of building "A." It had spread to mattresses and bedding on 3d floor which could not be extinguished by chemicals. Fire department arrived at 12.38, cut connections rang 3d alarm at 1.36, and a 4th at 1.40, when it had reached the upper floors of building "B."

All doors were closed in the party wall except that to front of building "B" on the 2d floor from which a hose stream was thrown into "A." At 1.40 that was shut and latched by the chief, and men withdrawn to the upper floors of "B." Salvage Corps covered pianos in the room till driven out by smoke. Pianos were subsequently destroyed in "B." Salvage Corps forced open the pair of doors on 3d story rear of "B" to outside elevator shaft to let the smoke out, but they shut them soon at about 2 p. m.

The greatest volume of smoke and fire and the direction of the wind was from front to rear. The battalion chief fought the fire from the rear of building "B" by knocking two holes through the rear walls of 7th and 8th stories at 1.55.

After the fire it was found that all merchandise on the upper stories of building "B" was totally destroyed; so also that in building "A." But that on 3d and 4th stories in "B" was not damaged by fire.

The floor beams were intact, their adamant covering crumbled. Brick walls in good condition except where broken about the front windows, and on 8th story rear elevator shaft.

The 3-inch partitions about the elevators on 2d, 5th, 6th and 7th stories of "B" were found broken down.

Steel frame elevator shaft with corrugated sides in building "A" was a complete wreck.

All pairs of doors to the outside elevator shaft were found closed with their latches and cross bars in place.

9. What are the conditions as to fire protection on Blackwell's, Randall's and Ward's Islands? What improvements if any would you suggest?

Laws and Ordinances. (Weight 1.)

1. You observe the following at fires at which you are present:
   (*a*) State in each case whether the condition is a violation of the law.
   (*b*) Give the essential provisions of the law governing each case.

   1. A wholesale dry-goods merchant has a number of empty wooden packing cases stored in a section of his basement which is 20 feet long, 10 feet wide and 7 feet high.
   2. A rag shop is located in the basement of a tenement house.
   3. In a ten-story office buiding there is a three-inch standpipe with a one-way three inch connection at the street in the sidewalk elevator shaft ten inches below the sidewalk.
   4. Packing cases are stored in a vacant lot having a metal fence fifteen feet

high and situated sixty feet from the nearest building which is a moving picture theatre.

5. In a house which is occupied by three families living independently of each other and doing their own cooking on the premises, the only means of egress in case of fire are the stairs which are situated in the rear of the house and the fire escape on the rear wall which may be reached from the windows of the public hall.
6. All the fireproof shutters at the front of a loft building are securely bolted from within and the firemen have great difficulty in forcing them open.
7. A retail druggist carries in stock flashlight powders for the use of photographers.
8. The only fire escapes in a three family tenement house are located on the side walls of the house and each tenant has access to this fire escape through a large bathroom of his apartment.
9. A fire has spread at night to an adjoining loft building before the arrival of the firemen, because although the second building was supplied with fireproof shutters, they had not been closed.

2. (*a*) State the conditions under which a fire marshal may legally force his way into a private residence for fire prevention purposes.
(*b*) Give a full account of the procedure you would take if you had reason to believe that a certain dry goods dealer in your district deliberately set fire to his store for the purpose of collecting insurance thereon.

3. What licenses and permits are issued by the fire department? What is the purpose of each? Name other permits and licenses issued by other departments with which the fire department is closely concerned.

4. A city ordinance provides that certain classes of buildings shall be "fireproof." Name them. What is the meaning of "fireproof" according to the intent of this ordinance? Give full details.

5. What fire appliances and means of protection against fire would you expect to find in a newly built
(*a*) Apartment house 8 stories high?
(*b*) Theatre?
(*c*) Department store, 6 floors?

Rules and Regulations. (Weight 1.)

1. Assume that you are in command of a division of 3 battalions of 8 companies each. In each battalion there are 5 engine companies, two of these being double companies, and 3 Hook and Ladder companies, one of which is a double company. Make out a schedule covering a period of 5 days, allowing all officers the leaves provided for in the rules and regulations and showing the officers in command of the various companies. State also how many officers you would require to carry out this schedule, assuming that the hours for meals are to be between 6.45 a. m. and 8 p. m.

2. (*a*) Describe clearly the difference between the inspection of companies by deputy chiefs and by battalion chiefs as prescribed by the rules and regulations of the department. Mention all important points of difference.

(*b*) Compare the powers of deputy chiefs and of battalion chiefs in the matter of making details and granting leaves to officers and members of the uniformed force.

3. Discuss the Fire College as to its purposes, courses offered, and the efficiency of the work accomplished. Make suggestions that appear to you advisable looking toward the extension of this work, including measures that you consider would increase its usefulness.

4. Describe the formalities that must be observed

(*a*) When a charge is preferred by a superior officer of the fire department against a subordinate.

(*b*) When a fireman prefers a charge against another fireman.

(*c*) When a civilian prefers a charge against a fireman.

Report. (Weight 2.)

The chief of department directs you to assume command of that division of the department in which are located most of the high loft buildings occupied as factories for the manufacture of clothing of various kinds. Most of these buildings are more than six stories in height; they are concentrated along the avenues and the streets of a congested district; many men and women are employed on each floor of these buildings; and there is a large quantity of inflammable trade waste on each floor.

The chief of department directs you to make an investigation of the fire hazard in this district with a view to reducing the danger to life and property which is at present existing in this district.

Write a report of not less than 300 words to the chief of Department, outlining the scope of the investigation which you have made in compliance with his orders, and presenting to him for consideration such specific recommendations for the reduction of the existing peril to life and property in this division as you feel you will be able to accomplish by means of the members of the uniformed fire-fighting force assigned to duty in this division. Give your reasons in support of each recommendation.

Regulating Building Heights.

From the Report of the Heights of Buildings Commission, City of New York.
Illustrations by courtesy of the Commission.

The general problem considered by the Commission comprises the regulation of building heights and open spaces and the location of industries and buildings.

Regulations relative to building heights and open spaces may be:—

(1) Uniform for all buildings within the city, without distinction as to class or location of building;
(2) Uniform for all buildings of the same class throughout the city;
(3) Uniform for all buildings or for all buildings of the same class in a given district or section of the city.

Uniform Regulations for All Buildings.

The simplest case of regulation is a fixed limit of height applying to all buildings within a city without distinction as to class or location of building. This is the usual and in most cases the first form that height regulation has taken in American cities. No case has been found where the constitutionality of such an ordinance has been directly before the courts, but in other cases the courts have stated that the right to make reasonable regulations of this kind is undoubted.

Regulations Varying with the Class of Building.

Height and court regulation varying somewhat with the class of building is a usual and quite generally approved method. One of the most usual forms of classification is a maximum height limit for buildings generally and a lower limit for tenement houses. In New York City the height of tenements is at present limited to 1½ times the width of the widest abutting street, while the height of other buildings is unlimited. In the second class cities of Massachusetts, no tenement may have more than one legally habitable story for each full ten feet of street width, unless it be set back from the street a distance equal to the excess of its height over that permitted at the street line. The height of other buildings is limited to 125 feet. In Chicago, the height of tenements is limited to 1½ times the street width, while the height of other buildings is limited to 200 feet. In Boston, the height of all buildings is limited, with the exception of coal hoists, grain elevators and sugar refineries.

A special act of the Maryland legislature passed in 1904 limits the height of buildings within one block of the Washington Monument in the

city of Baltimore to seventy feet. Churches are exempted from the provisions of this act. The constitutionality of this exemption was upheld by the Maryland Court of Appeals. This was on the ground as stated by the court that churches "do not present the same danger from fire to the surrounding buildings as many other structures do, chiefly because they are not likely to become very numerous in any one locality."

In regulations as to required open spaces about buildings the tendency to apply special regulations to each class of buildings is even more pronounced than in the regulation of height. Thus in present laws in force in New York City, special regulations as to open spaces are applied to each of the following classes of buildings: hotels, office buildings, theatres, lodging houses, dwelling houses, tenement houses.

An objection to height and open space regulation based on class of building is that it may result in a partial defeat of the chief purpose of regulation, which is to better light and air conditions. A tenement house has special restrictions as to height and as to courts, but if a factory may be built adjoining such tenement without restriction as to height or courts, the chief result may be to insure improved light to the factory at the expense of the tenement. Regulations as to height and open spaces are usually based on the supposition that they will be adequate if all adjacent buildings conform to the same regulations. They assume a reciprocity of limitation and advantage. This reciprocal relation may be destroyed if different types of buildings in the same district are subjected to different regulations as to height and open spaces. While, however, a general uniformity is desirable, such uniformity need not be absolute. Some exemption or special restriction will almost always be required for certain classes of buildings that are not segregated but are scattered throughout the city, such as churches, theatres, schools, hotels, etc. Moreover, considerations of safety may require an absolute height limit for certain buildings, such as factories or department stores, that would be unreasonable if applied to all buildings.

Regulations Varying with the Particular District.

Every large city that has made a serious study of the question of regulating heights and open spaces has been forced to the conclusion that an effective solution cannot be secured without a division of the city into districts and the application of special regulations to each district or class of districts.

The General Scope of Constitutional Regulation.

It is clear that such restrictions as are enacted must justify themselves as a reasonable exercise of the police power of the state. Under eminent domain the individual is compensated for the taking of his property. Under the police power there is also a constructive taking of property in certain cases, but without compensation to the individuals injured. It is theoretically conceivable that a general plan of building restriction and reg-

ulation might be entered upon by resort to the power of eminent domain, but, practically, such a solution is out of the question. The expense and burden of condemnation proceedings and litigation in multitudinous cases would create a tax burden that would increase rather than compensate for the injury to property interests. Moreover, the kinds of regulation under consideration are not such as to justify individual compensation. While they restrict individual liberty to a certain extent they do it in such a way as to conserve individual and public interests and rights. They subject the use of urban land to such restrictions as are appropriate and reasonable in the nature and history of this class of property.

The police power may be used to promote the public health, safety, order and general welfare. Protection of public health, safety and order constitute the police power in the primary or narrower sense of the term.

It is a power so vital as to be undoubted when reasonably and justly applied. The exercise of the police power for the promotion of public comfort and convenience, and for the promotion of general social and economic interests under the head of "the general welfare," while upheld by competent authority, will nevertheless be subjected to more careful scrutiny and more strict construction.

Bearing in mind the purposes and objects which justify a resort to the police power our study of the problem of controlling building development will be based chiefly on the following considerations:—

(1) *Public safety.*—Protection of property from fire and protection of the occupants of buildings from injury due to fire or panic.

(2) *Public health.*—Importance of light, air and the prevention of congestion, to health and sanitation.

(3) *General welfare.*—(*a*) The comfort and convenience of the occupants of dwellings, offices and factories, through more adequate provision for light and air, and in the case of dwellings through the maintenance of the essentially residential character of the neighborhood.

(*b*) The safeguarding of existing and future building investment values and the encouragement of an appropriate and orderly building development by such regulations as will prevent the taking from an existing structure of its minimum allotment of light and air, and as will tend to maintain the character of a district.

(*c*) The prevention of street congestion.

Regulations Based on Street Width.

Numerous height regulations are made to vary in some measure with the width of the street. In European cities the limitation based on street width is in most cases the fundamental restriction on the height of buildings. In America this restriction at present plays a much less important part. It may be said to be fundamental in the general height restrictions of Washington and to be of great practical importance in those of Boston. It is also a very important factor in height restrictions for tenement houses. In New York City no tenement house may exceed 1½ times the street width.

In some cases the height allowed is exactly proportional to the street

width. In other cases special limits are provided to govern the case of either very wide or very narrow streets. In general, limitations based on street width may be classified as follows:—

1. The street width, or some multiple thereof.
2. The street width increased or diminished by an arbitrary unit.
3. The street width increased by the amount of set-back.

The most common limitation on height in Germany is the street width either taken by itself or increased by an arbitrary unit. Special exemptions are, however, frequently made in the case of the narrower streets in the inner city—the street, no matter what its width, being assumed as of a given width. The multiple of the street width is rarely found in Germany, and in no case is it applicable to an entire city. Where utilized, the multiple is generally much smaller than that in American cities. In Breslau, Dantzig and Oberhausen, for instance, it is one and one-fourth times the width of the street. In Bielefeld, Lübeck and Stettin, it is one and one-half times the width of the street. In Boston (except as elsewhere noted), Charleston, Cleveland, Erie, Fort Wayne, New Orleans and Youngstown, on the other hand, the multiple is two and one-half times the width of the street. With Washington, these cities are the only cities in America that base the general height limitation of all buildings on the street width. Boston, Cleveland and New Orleans include the set-back in the width of the street. Washington is the only city found that bases the height upon the width of the street diminished by an arbitrary amount. As described elsewhere, the height of buildings on residential streets, more than seventy feet in width, may not exceed the width of the street diminished by ten feet. In cities of the second class in New York no building to be used for living purposes, except a hotel, may exceed in height the street width, nor in any case may it exceed one hundred feet in height.

The width of the street would seem to have a certain bearing on most of the purposes for which height limitations are prescribed. It directly affects fire prevention, light and air conditions and street congestion. It seems to be an essential factor in any thoroughgoing treatment of the problem of height regulation.

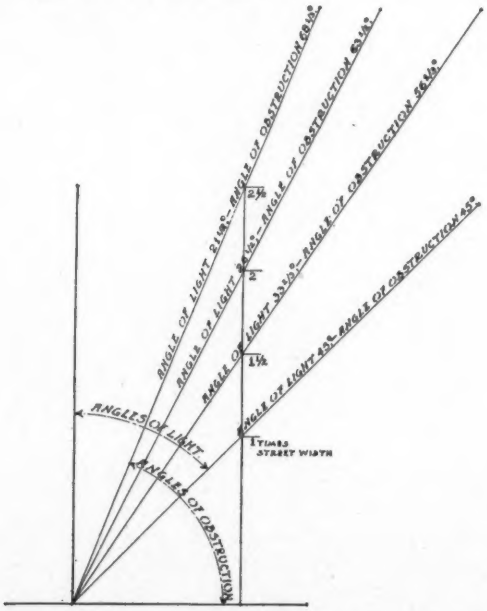
Regulations Based on Maintenance of a Minimum Angle of Light.

A limitation based directly on street width maintains a constant minimum angle of light for the front of the building at the ground floor. If prescribed height is equal to street width this minimum angle of light is 45°; if one and one-half times street width, it is 33⅓°; if two times street width, it is 26½°; if two and one-half times street width, it is 21⅔°. The converse of this is that the maximum angle of light obstruction will be the difference between the above amounts and 90°, *i. e.*, 45° for height limit equal to street width; 56⅔° for height limit one and one-half times street width; 63½° for height limit two times street width; 68⅓° for height limit two and one-half times the street width.

From the diagram it is clear that a flat limit of height is not necessary

in order to secure a minimum angle of light. If the height limit based on street width is made to apply only to the elevation of the building at the street line, and other portions of the building are set back in the same ratio as height limit to street width, the angle of light is maintained. If the height limit is twice the width of the street a set-back after reaching the height limit at the street line of five feet for every ten feet of increase in height will maintain the angle of light at 26½°.

Provisions for courts in tenement house and general building regulations are sometimes based in part at least on the maintenance of a minimum angle of light. This basis does not usually appear on the face of the law, but has nevertheless been used in determining the prescribed factors. In London, the angle of light is more expressly stated. The rear heights of a building are in general regulated by a line drawn at an angle of 63½° to the horizontal toward the building from the rear line of the lot. That is, a building may not be built so as to obstruct the light of the adjoining lot in the rear at an angle of more than 63½°.



Angles of Light and of Light Obstruction at Ground Floor on Street Front.

Exceptions to Angle of Light Rule.

While light is important, it is not the only object that height and court regulations are intended to secure. Air and ventilation are at least of equal importance. It is of course true that if a liberal angle of light is

provided it will usually carry with it adequate provision for air and ventilation. If, however, in the case of a court the angle of light is small and the air is not renewed and kept in circulation, the question of ventilation may require separate consideration. This constitutes one reason for a requirement of a minimum open court across the rear of the lot. In the suburbs, moreover, where lower land values make liberal provision for open spaces appropriate, this factor may well be considered apart from the safeguarding of a minimum angle of light.

The diminution of congestion of streets, buildings and districts, is also an important purpose to be served by height and court regulations. Absence of congestion in residence districts makes for more wholesome conditions and favors the physical and civic health and well-being of the community. This purpose, like that of air and ventilation, usually may be provided for by limitations based on angle of light.

Protection against fire is another important purpose that may be served by height and court regulations. If the maintenance of a certain angle of light permits the construction of buildings higher than warranted by considerations of fire prevention and safety to occupants, the simple rule of light angle should be supplemented to provide for such contingency.

A very general exception to the angle of light rule is found in most height regulations based in general upon street width. The rule as to multiple of street width is not applied to very narrow streets in the business center, nor is it applied to streets of more than a prescribed width. In other words, as an exception to the general rule, there is a minimum height that will be permitted and a maximum height that may not be exceeded, regardless of street width. It is clear that a general multiple, if applied to certain narrow streets in the business center, might seriously depreciate land values and interfere with the most beneficial use of the land. Such a result would not be in the public interest, and would seem to render the regulation unreasonable and of doubtful constitutionality. As shown more fully below, reasonableness is largely a matter of degree. There must be some fair relation between the public good to be secured by the regulations and the private injury suffered. Moderation and proportionateness of means to ends is of the essence of reasonableness. It seems that classification or exemption that is essential to the reasonableness of a regulation is itself reasonable.

HIGH BUILDINGS.

A classification of buildings in New York City, according to use, reveals the fact that hotels, and not office buildings, possess the greatest average building height. Hotels have an average height of 8.0 stories; department stores, 7.8 stories; office buildings, 7.0 stories; factory building, 5.9 stories; stores and dwellings, 5.3 stories; dwellings, 4.8 stories; stores, 4.0 stories, and warehouses, 3.9 stories. But, of the ninety buildings over seventeen stories high, nine are factory buildings, ten are hotels and seventy-one are office buildings. It is clear, therefore, that while hotels have the greatest average height, the much greater proportion of

high office buildings, and their concentration in a few areas, make the determination of a maximum rule applicable to all buildings very largely a question of determining what rule will be most appropriate for office buildings in the areas of maximum congestion.

Public Safety.

The New York building code requires that all buildings over 150 feet in height be thoroughly fireproof. The buildings themselves cannot burn, because there is nothing combustible in their construction. All high buildings are equipped with standpipes and ample tanks at various levels, and many of them with automatic sprinklers. Doors and windows between rooms and between rooms and corridors are fireproof, so that fire can be confined to a single room. There are many interesting examples of such fires.

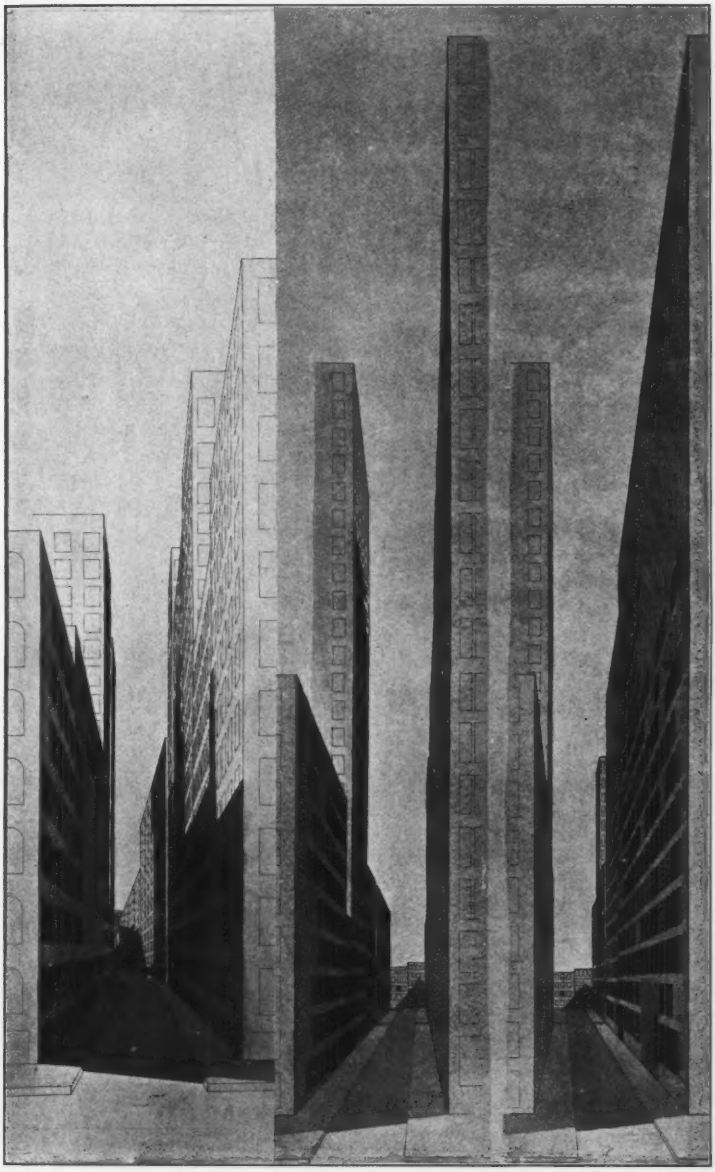
The fact remains, however, that tall buildings are not necessarily safe. The rooms are often filled with highly inflammable material. Unless doors are closed, fire may easily spread to other rooms. The draft up the chimney-like elevator wells may pull the flames across the corridor, and the flames, fed by the grease on the elevator guides, may be carried to upper floors. Under such conditions the danger of panic among the employees of the building would be very real, and the higher the building the greater the danger.

The fire department cannot fight a fire from the outside more than eighty-five to one hundred feet above the ground. Above that they must rely on the standpipes in the building. If the standpipe does not work, or if the fire is so near the standpipe as to render its use impracticable, the fire department becomes helpless. No fatal fire in a modern high building has yet occurred, but it is not an impossibility.

In case of general panic or catastrophe causing the occupants of all offices in all buildings in the high building district to seek the streets at once, a serious situation would present itself. It would be impossible for all the occupants of all the buildings abutting on certain streets to move in the street at one time, even though the street were cleared of all other traffic, pedestrian, vehicular and surface car, and absolutely free from all obstructions, so that the entire width of the street might be used. The minimum space required by a crowd moving in one direction is five square feet per person. Computed in this manner, Broadway could hold but 96.3 per cent of its occupants; Trinity Place and Church Street, 86.6 per cent; Nassau Street, 69.3 per cent; New Street, 44.5 per cent, and Exchange Place only 37.5 per cent. This being the situation to-day the question arises as to what might happen in case of a general panic should the entire district be solidly built up with buildings of the present extreme heights.

Public Health.

In areas where high buildings are crowded together most of the rooms even on the street front are inadequately lighted, and many are decidedly dark. On New Street and Exchange Place, where the office buildings



A B

Use of artificial light in offices: (A) on New Street looking south from Wall Street; (B) on Exchange Place from Broad Street west.

The black windows indicate where artificial light was being used near the windows at noon on a sunny summer day.

range from ten to twenty-two stories high, on a bright, sunny day at noon in midsummer, it was found that in almost all of the street rooms artificial light was being used next to the windows. The conditions in the interior courts in parts of the tall building district are even worse.

Even with modern artificial lighting of the most approved type, the dark offices have caused a great deal of eye strain. Nothing but adequate natural light seems to prevent it. Tuberculosis experts testified to the Commission that they had found many cases of tuberculosis directly traceable to working in dark offices. A noticeable increase in sick leave has been found among the employees of firms that have moved from light to dark offices.

Public Comfort and Convenience.

A number of streets in the high building district are already so congested that pedestrian and vehicular traffic is greatly impeded. Assuming that pedestrians will use sidewalk space only, and will move in one direction only, there is room on Trinity Place and Church Street for but 56 per cent of the occupants of the buildings located on those streets; * on Broadway, 50 per cent; on Nassau Street, 32 per cent, and on New Street, but 19 per cent. If these same streets should be uniformly built up to an average height of thirty stories, the above percentages would be reduced to: 26 per cent on Broadway; 20 per cent on Trinity Place and Church Street; 11.9 per cent on Nassau Street; 8.9 per cent on New Street, and 8.4 per cent on Exchange Place. It is quite clear that under such conditions the street capacity would be entirely inadequate to take care of the morning, afternoon and noon hour crowds.

Property Values.

Few skyscrapers pay large net returns. Most of them pay only moderate returns. The cost per cubic foot of tall buildings is greater than that for low buildings. The exact difference can only be approximated because there are so many factors which affect the problem. However, the very tall buildings demand many things out of proportion to their increased bulk. All piping has to be made disproportionately heavier; special pumps and relays of tanks have to be provided, foundations often call for special construction, wind-bracing assumes an important place, long-run elevators are more costly than short-run elevators, the extra space taken up by the express run of the elevators is an additional cost. Thus in the aggregate, the total cost per cubic foot of a very tall building may be sixty to seventy-five cents, where a low building of the same class would cost only forty to fifty cents per cubic foot.

The net rentable space on the ground floor is worth on the average as much as that of the third to the eighth floors inclusive. Loss of rentable ground floor space is always serious, and must be compensated for in other ways if the building is going to pay. The exceptional size of the columns

* This estimate is based on an allowance of five square feet per moving person.

and the exceptional space taken by pipes and ducts on the lower floors alone have a serious effect on the net rentable area. However, the great item of waste in the high building is the big loss of valuable renting space on the lower floors due to the dead run of the express elevators to the upper floors. This amounts to from fifty to sixty-five square feet per elevator per floor. In a thirty story building with thirty elevators this means on the ground floor 1800 square feet given up to elevators, and at least as much again given up to the lobby, so that about four thousand square feet is lost. As this ground floor space in such buildings often rents at $20 per square foot, the loss to the building is $80,000 on this floor alone. A ten-story building would save two thirds of this. The loss on the floors above due to the dead run of elevators also amounts to a surprising total, all of which would be saved in a ten or twelve story building. This means that tall buildings reach a limit beyond which the loss in space on the lower floors more than counterbalances the profit on the upper floors. Every building according to its shape, size, location and use has its economic limit.

But even though a high building may pay a moderate net return as long as it is isolated and surrounded by low buildings, so that all its floors and offices are light and attractive, the result may be very different after it is surrounded by similar buildings, shutting off light and reducing rentals on the lower floors. As a rule, in an area in which high buildings predominate the rentals are lowest, and the percentages of vacancies greatest on the lower floors above the second. If before the high building development, the owners in such districts could have covenanted among themselves to limit heights and enlarge courts, it would undoubtedly have been to the advantage of all concerned.

The real estate interests which a decade ago were most active in opposing the adoption of a height limit in Boston are to-day among its staunchest supporters. The consensus of opinion among real estate men in Boston is that the height limit, instead of depreciating land values or retarding the improvement of property, has been an unqualified success.

Existing Height and Area Limitations in New York.

Height Limits.

The only direct limitation on the height of buildings in New York is that restricting the height of apartment and tenement houses to one and one-half times the width of the widest abutting street. There are, of course, other provisions in the building code, the city charter, the labor law and the tenement house law that constitute a very real limitation on the height of buildings, but all of these are indirect limitations. The most important of these provisions are those regarding open spaces and fireproofing.

Open Spaces.

The open space requirements vary considerably with the type of building. No open space is required in the case of factories, stores and ware-

houses. Dwelling houses, hotels, lodging houses, office buildings, tenement houses and theatres are, however, subject to special provisions of varying stringency.

Dwelling houses may cover 90 per cent of the lot area.

Hotels situated on corner lots and covering an area of not more than three thousand square feet are prohibited from occupying more than 95 per cent of the lot area above the second floor level. Hotels situated on interior lots are prohibited from occupying more than 90 per cent of the lot area above the second story level. An additional 2½ per cent of uncovered lot area must be provided for each and every story over five. The open space provisions with reference to hotels situated on inside lots are tantamount to a maximum height limitation of forty-one stories. In the case of a twenty-one story hotel the open space would equal half of the lot area.

Lodging houses may cover 65 per cent of interior lots and 92 per cent of corner lots.

Office buildings situated on interior lots may cover 90 per cent of the lot area at and above the second floor level. Office buildings situated on corner lots up to three thousand square feet in area may cover the entire lot area.

The amount of open space demanded in the case of apartment and tenement houses is dependent upon the vertical and horizontal dimensions of the building, its interior arrangement and occupancy, the shape and size of the building site, and its location. Tenements situated on corner lots up to three thousand square feet in area may occupy 90 per cent of the lot area. Tenements situated on interior lots more than ninety feet, but less than 105 feet in depth, may occupy up to 70 per cent of the lot area. Tenements situated on certain other kinds of lots may occupy up to 65 per cent of the lot area.

Theatres and opera houses must be provided with rear and side courts. The width of these courts must be proportioned to the seating capacity.

Height Limitations in American and European Cities.

The maximum height limit in America is, as a rule, set so high that it limits the height of buildings only when what might be termed the logical height limit for that particular city or locality has been very much exceeded. In other words, the maximum height limit is no height limit at all so far as most buildings are concerned; it only prevents the erection of a few exceptionally high buildings. It does not limit or condition the character of the great mass of buildings erected even in the central business district. In Boston, Chicago and Washington, however, the present maximum height limits do constitute a very practical restriction, as evidenced by the tendeney in certain districts to build up to the full height allowed by the restrictions. The following is a tabulation of height limits in certain American and European cities:—

American Cities.

Baltimore	175 feet	Portland, Ore.	160 feet
Boston[1]		Rochester[2]	
District A	125 "	Scranton	125 "
District B	80–100 "	Youngstown[1]	
Buffalo[2]		Fort Wayne[1]	200 "
Charleston[1]	125 "	Providence	120 "
Chicago	200 "	Salt Lake City	125 "
Cleveland[1]	200 "	Toronto[3]	130 "
Erie[1]	200 "	Washington, D. C.	
Indianapolis	200 "	Pennsylvania Ave.	160 "
Los Angeles	150 "	Business Streets[4]	130 "
Manchester, N. H.	125 "	Residence Streets[5]	85 "
Milwaukee	225 "	Seattle	about 20 stories
New Orleans[1]	160 "		

European Cities.

Aix-la-Chapelle	65.6 feet	Hanover	65.6 feet
Altona	72.2 "	Kiel	72.2 "
Berlin	72.2 "	Leipzig	72.2 "
Bremen	62.3 "	London	80.0 "
Breslau	72.2 "	Lübeck	59.0 "
Cologne	65.6 "	Magdeburg	65.6 "
Dortmund	65.6 "	Munich	72.2 "
Dresden	72.2 "	Paris	65.6 "
Duisburg	65.6 "	Posen	65.6 "
Dusseldorf	65.6 "	Rome	78.5 "
Edinburgh	60.0 "	Stockholm	72.2 "
Elberfeld	65.6 "	Stuttgart	65.6 "
Frankfort	65.6 "	Vienna	82.0 "
Halle	59.0 "	Zurich	43.0 "
Hamburg	78.7 "		

[1] Not to exceed two and one-half times width of widest street.
[2] Not to exceed four times average least dimension.
[3] Not to exceed five times least dimension at base.
[4] Not to exceed street width plus twenty feet.
[5] An intermediate height between sixty feet and eighty-five feet on streets over seventy feet wide—height not to exceed width of street minus ten feet; sixty feet on streets from sixty to seventy feet wide; and street width on streets less than sixty feet wide.

DISTRICTING.

As applied to building restriction there are two general types of districting. Certain localities may be set off as residential or business or industrial districts. Industry and business may, for example, be excluded from the residence districts. The restrictions may go further and attempt to secure a certain type of residence district. The district may be restricted to one family or two family houses. Another type of districting is where different general height and area limitations are applied to all buildings in a particular district. Any thoroughgoing plan for the control of building development must make use of both of these types of districting.

Constitutionality of Districting.

While the desirability of districting is generally recognized by all students of this subject, there is a fear on the part of some that it may be held void as an infringement of the constitutional guarantee of equality. The constitutional guarantee of equal protection of the laws constitutes one of the most important limitations upon the police power. It means that the government shall not impose particular burdens upon individuals or corporations to meet dangers for which they cannot in justice be held responsible, and that all legislative discriminations or classifications shall be justified by differences of status, act or occupation corresponding to the difference of legislative measures. The idea of equality excludes in principle both particular burdens and special privileges, but admits of reasonable classification.

The question what constitutes reasonable classification comes up chiefly in connection with districting. To what length is it permissible to go in the division of the city into districts with varying regulations as to the height, size and arrangement of buildings? Other forms of classification have received quite general acceptance. Thus tenement houses have often been put in a separate class and subjected to more stringent regulations. This has been justified on the ground of greater importance in relation to public health or safety. Likewise height regulations have been adopted, varying according to the width of the street. This is in effect a districting plan. The district changes with each variation in street width. This sort of districting is usual and approved. It may be justified directly on the ground of health and safety. A general plan of districting, such as seems needful, cannot be justified solely on such grounds. We cannot justify more stringent regulations for dwellings in the suburbs than in lower Manhattan, on the ground that light, air and comfort for the residents of the suburbs are of greater public importance than for the residents of lower Manhattan. It seems, however, that such districting can be justified if it can be shown to be essential to the general welfare. If regulations admittedly appropriate and reasonable for suburban areas are admittedly inappropriate and unreasonable for congested areas, the public importance and necessity for districting are clearly shown.

Classification or districting for the purposes of regulation must either be based directly on the purposes for which the police power may be exercised, or it must be justified by difference in injury to vested interests. In order to justify more stringent regulations for dwelling houses in the suburbs than for dwelling houses in lower Manhattan, it must appear either that such regulations for the suburbs are more important to the public health, safety or general welfare than for lower Manhattan, or that while equally important for one or more of these purposes in both districts, the suburban regulations would, if applied to lower Manhattan, interfere so seriously with existing property values as to render them of doubtful expediency or constitutionality. The courts will insist that there be some fair relation between the public good to be secured by the regulation and the private injury suffered. Building regulations must be reasonable in order

to be constitutional. There is no absolute standard for all conditions. There must be a reasonable relation between the public object to be gained and the loss of property and liberty suffered. It is clear that any deprivation of individual liberty is a real public loss that must be justified by some greater public gain. It is also clear that extended injury to property interests may cause widespread public loss, and consequently should have for its justification as an exercise of the police power some greater public gain.

The districting of a city for building restriction purposes is made necessary by the fundamental characteristic of "reasonableness," which is the essential feature of a valid exercise of the police power. Especially in a great city like New York, it becomes necessary that building regulations should vary according to the character of the district and according to the type and use of the building. In certain districts suburban conditions of light and air can be maintained with great public advantage and with slight private loss; in other districts such favorable conditions of light and air, while theoretically just as desirable, are entirely impracticable, and any law that attempted to enforce them would be clearly unreasonable and void.

A classification based on proportionateness of means to ends is recognized in practically all building regulations. General maximum height regulations, for example, apply only to buildings hereafter constructed. In doing so they discriminate in favor of the owners of buildings already constructed. A lopping off of existing buildings in excess of the prescribed height is of no less importance to the health, safety and convenience of the public than the restriction of the height of an equal number of buildings hereafter to be erected. A discrimination in favor of buildings already constructed cannot be justified directly on the grounds for which the police power may be exercised. Such discrimination or classification finds abundant justification, however, when we apply the controlling principle of reasonableness and proportionateness of means to ends. The reconstruction of existing buildings would impose burdens on private owners disproportionate to the public gain. Such regulations would therefore be unreasonable and void. It seems that classification or exemption essential to the reasonableness of a regulation is itself reasonable. This principle constitutes an adequate justification for districting.

While a specific regulation taken by itself may not seem to have a very direct relation to the purposes for which the police power may be invoked, yet when taken as a part of a comprehensive plan for the control of building development throughout the entire city, its relation to such purposes may be unmistakable. Grant that a comprehensive system of districting is essential to the health and general welfare of the city, and it follows that every specific regulation that is an essential part of such comprehensive system is justified under the police power.

Necessity for Districting.

In this country comparatively little use has been made of districting. It has been carried out most fully in certain European cities. It is coming

to be recognized as essential to well ordered, purposeful, economic and socially beneficial city growth. Haphazard methods of city construction result in a minimum of convenience with a maximum of cost to the public, and, in general, to the individual as well.

The welfare of the people of a city is very largely dependent on the skill and foresight with which the city has been built. Upon this depends their opportunity for agreeable and remunerative occupation, for the enjoyment of leisure and the creation of a home. If factories and offices are dark and poorly ventilated, the worker suffers in health and comfort. If dwellings are huddled together without adequate provision for open spaces, and if dwellings, stores and factories are thrown together indiscriminately, the health and comfort of home life are destroyed.

It will pay a city to attempt by every available means to conserve the health and general well-being of its inhabitants. This means increased productivity, and increased productivity means higher wages for the laborer, higher profits for the employer and higher rents for the real estate owner.

The need for the creation of special restrictions for special districts is most clearly exemplified in the case of suburban residence districts. Here real estate developers have often found it profitable to secure control of large areas, in order, by restrictive covenants, to insure to intending purchasers of homes the creation and maintenance of a residence section of a certain desired type. The surroundings and neighborhood are all important in securing desirable home conditions. Unless the general character of the section is fixed for a considerable period of years no one can afford to build a home. If he does build, a change in the supposed character of the neighborhood, through the building of apartments, stores or factories, may render the location undesirable for a home of the character he has built, and thus greatly depreciate his investment.

Another general social factor that demands the zoning or districting of the city for building purposes under the police power is the recognized evil of congestion of population, as exemplified on the lower East Side. All students of the subject recognize that such congestion of population is a real detriment to the health and civic fitness of the population of the district and a real menace to the welfare of the entire city. The problem is to prevent the repetition of these conditions in other parts of the city. Restrictions that would be upheld as reasonable for the present congested area would be clearly inadequate to prevent the repetition in other districts of conditions almost as bad as those now existing on the lower East Side. The only method by which this can be accomplished is by permitting the creation under the police power of different restrictions for different sections. Surely the prevention of undue congestion of population is a matter of such vital importance to the general welfare that it will justify any reasonable classification of buildings according to type and district, especially if the injury to vested interests resulting from such classification is comparatively small.

Manhattan with its skyscrapers is comparatively undeveloped. It is a fact that a large proportion of the area of lower Manhattan is now so

poorly developed that the existing improvements are reckoned of no value for purposes of purchase or sale. The bare value of the land is all that is considered. This means that a large portion of the land of Manhattan is very inadequately utilized. Where space is so scarce this inadequate utilization is a great social and economic loss. This partial development and poor utilization of the land is even more apparent in all the other boroughs. A considerable percentage of the land even in what are considered built-up districts is either vacant or very inadequately utilized. In the suburbs the sprawling character of building development is everywhere apparent. The natural result of a poor utilization of its land area by a city is high rents for occupiers and low profits for investors. It may seem paradoxical to hold that a policy of building restriction tends to a fuller utilization of land than a policy of no restriction, but such is undoubtedly the case. The reason lies in the greater safety and security to investment secured by definite restrictions. The restrictions tend to fix the character of the neighborhood. The owner therefore feels that if he is to secure the maximum returns from his land he must promptly improve it in conformity with the established restrictions. For example, he will not be deterred from immediate improvement by the consideration that while a detached house is at present an appropriate improvement, it is probable that in ten years an apartment house would be appropriate, and that by waiting he will not only be able to reap the advantage of greatly increased land values, but will save great depreciation in the value of the detached house, due to the fact that it has become an inappropriate improvement for the lot.

The same principle applies in the case of most types of buildings. As a general rule, a building is appropriately located when it is in a section surrounded by buildings of similar type and use, all of which have been constructed with reference to that particular use. Anything that will tend to preserve the character of a particular section for a reasonable period of years will tend to bring about the uniform improvement of the section. A large proportion of the land of New York City that is now unimproved or poorly improved is in that condition because the owners feel that the character of the section is changing, is bound to change in the near future, or that the permanent character of the section is unknown. If restrictions were imposed so that the general character of particular sections could be forecasted with reasonable certainty for a period of years, owners who had been holding back on account of the uncertainties of the situation would find it clearly to their advantage to improve their holdings. The result would be that these restricted sections would be more quickly built up with buildings of similar type and use. This should have the effect of improving living conditions, reducing the cost of living and maintaining real estate values.

Any growing city that fails to control building development must inevitably suffer enormous loss, due to building obsolescence. Obsolescence may be defined as lack of adaptation to function. It results from changed conditions and surroundings that render the building an inappropriate improvement for the particular location. The total social loss does not

consist merely of the great cost of building reconstruction, or of the great decline in the rental value of the inappropriate buildings that are not reconstructed, but there is added to this the social loss due to the retardation of real estate improvements, owing directly to the obsolescence hazard.

In a memorandum submitted to the Commission by Frederick L. Ackerman, the importance of districting and its superiority over private restrictive covenants is clearly pointed out. Mr. Ackerman says:—

> We should not confuse the term "zoning" with the ideas surrounding the present use of the word "restriction." It is true that restrictions upon property are a necessary part of any scheme of zoning, but there is a fundamental difference in the nature of the restrictions. When a group of individuals restrict a section of the city, it is done for the purpose of conserving that section for a particular use. In practice this object is rarely attained, for the simple reason that there are parcels of property within that section which, for one reason or another, are withheld, with the result that sooner or later these pieces are used for a purpose detrimental to the adjacent property, causing the restricted property to depreciate in value. Ofttimes the restrictions made by individual owners hamper seriously the growth of a section, and in practice, instead of conserving the section to a better development of the particular activity for which it was intended, these restrictions simply serve as a check upon its development, owing to the fact that owners know that sooner or later the restrictions will be removed, when other activities will enter and disintegrate the values. When the city places restrictions over a section, these apply to all properties, with the result that there immediately begins a more permanent development along the lines for which the section is to be used, and properties increase in value.
>
> We have given too much weight to the ideas surrounding geographical location, and have not considered seriously the idea that the value of property depends upon the degree to which a certain section is developed for a certain use. Values appreciate in sections where it is known that the development is to be maintained along definite and well established lines. For instance, the values in office building sections are dependent upon the degree of the development of that section for that particular use. This idea holds in loft, factory and residential sections, shopping districts and the like, and experience has taught us that as soon as new elements are introduced into these sections of a nature tending to lower the standard of the section, the values of the properties are correspondingly reduced. There is no economy in the present method of continually shifting geographically the various interests of the city. We should rather foster the idea of developing various sections for a particular use, and place a premium upon the erection of permanent, well designed structures within that section, to be used for that particular purpose for which the section is restricted.

CONCLUSIONS AND RECOMMENDATIONS.

The Commission finds conclusive evidence of the need of greater public control over building development. The present almost unrestricted power to build to any height, over any proportion of the lot, for any desired use, and in any part of the city, has resulted in injury to real estate and business interests, and to the health, safety and general welfare of the city.

There are many cases where high buildings have destroyed rentable values of neighboring buildings, and in turn, perhaps, have had their own rentable values destroyed by other buildings. There are limited areas that seem in process of being smothered by their own growth; light and air are being largely shut off, and the streets are becoming entirely inadequate. There are high class business districts, such as lower Fifth Avenue, that

have seen property values impaired by the encroachment of factories. There are high class residence districts in which great property losses have resulted through the coming of stores and apartment houses. There are areas in The Bronx and in Brooklyn where lower East Side conditions of excessive congestion of population are being repeated.

Profiting by past experience, we can do much to safeguard the future. We can prevent the repetition all over the city of conditions and evils now confined to comparatively limited areas. Regulations, however, must be carefully devised so as not to interfere unduly with existing property values. We believe that well considered restrictions can be worked out, which, instead of proving a menace to property values, will in general tend to conserve, and in some cases to increase property values. Reasonable restrictions on the use of land will work to the mutual advantage of all owners.

The Commission heard the testimony and opinions of real estate experts, including the heads of several institutions which lend great sums of money secured by mortgages on real estate. This testimony of experienced men supported the opinion of the Commission that real estate values will be conserved and rendered far more stable by regulations materially limiting the height of buildings, providing for appropriate yards and courts, and restricting various districts against the intrusion of unsuitable industries.

We believe that the state has adequate power to adopt reasonable regulations of this kind. Under the police power the state may adopt any reasonable and appropriate regulation for the promotion of the public health, safety and general welfare. If it is true, as we believe, that the adoption of a reasonable control over building development is essential to the business interests and to the general welfare of the city, we are convinced that the exercise of such control is constitutional. Other American cities have been using the police power to regulate the height and use of buildings. These regulations have in the main been sustained by the courts. New York City has for many years restricted the height, size and arrangement of tenement and apartment houses. We merely propose, for the most part, a more general application and extension of methods of control already in use in the building regulations of this city.

General Restrictions for All Buildings.

An urgent problem is the establishment of general regulations that will relieve the situation in lower Manhattan. An occasional building of extreme height is not a matter of great public importance, but when, as in parts of the office and financial district, such buildings are crowded together, shutting off light and air and congesting the streets, the evil becomes one of grave public concern. The process has now gone far enough to make it plain to any observer that if permitted to continue until the district is uniformly built up with structures of the present extreme heights, the situation will be intolerable and injury will be done both to public and private interests.

A building of excessive height is not necessary in order to realize the maximum net return from the land. The tallest buildings often do not pay the best. The entrance hall, elevators, stairs and services take too much valuable space. Even supposing the building can be advantageously rented at the start, its prosperity will probably continue only so long as it is not surrounded by buildings of similar height. When high buildings are crowded together the result is mutually disastrous to all owners. Artificial light must be used on the lower floors even on the brightest day in summer. The darker offices usually rent for much less than those with better light. When such conditions prevail it is clear that a reasonable restriction on height and court area, if applied at the start, would have been greatly to the advantage of all owners concerned.

Lack of sunlight and the continuous use of artificial light undoubtedly have a direct relation to health, eye strain and general physical and mental efficiency. Equally injurious is the lack of adequate ventilation due to the opening of workrooms on deep and narrow courts within which any circulation or renewal of air is difficult. The health and comfort of the hundreds of thousands of office employees is a matter of great public importance.

The public also has great interest in the effect which tall buildings have on street conditions. The streets are being darkened and congested. Pedestrian and vehicular traffic is becoming slow and difficult. The street subsurface is becoming overcrowded with sewers, pipes, wires and rapid transit subways; all occasioned in considerable measure by the extreme heights of buildings.

In recommending restrictions we have necessarily been limited by existing conditions as to improvements and land values in the office and financial district. Were it not for the existence of many tall buildings, other and more nearly ideal restrictions could be imposed. The restrictions recommended are designed to secure as much light and air, relief from congestion and safety from fire as is practicable under existing conditions as to improvements and land values. In place of proving a menace to existing values they will tend to prevent future serious injury to such values.

The restrictions recommended are intended to apply, until superseded in part by the districting plan hereinafter proposed, to all buildings throughout the city, with the exception of tenement houses, and with the exception in the case of hotels, lodging houses and theatres of the requirements in regard to courts. Existing requirements as to height and courts of tenement houses, and as to courts of hotels, lodging houses and theatres are more stringent than the regulations we propose for general application.

While the restrictions recommended are necessarily somewhat detailed and complicated their general purport may be briefly summarized. They limit height at the street line to twice the width of the street, but such limit shall in no case be less than one hundred feet, nor more than three hundred feet. After reaching such limit the building may be carried higher by setting the street walls above such limit back one foot for each four feet of increased height. This will permit the building of mansards

or of vertical walls, if such walls are set back in the prescribed ratio of one to four. No cornice may project into the street more than five per cent of the street width. In order that the proposed height regulations may be effective in securing a maximum of light in the streets, it is obvious that the cornice projection must be limited. Ten-foot cornices on both sides of a thirty foot street cut off more light than many feet of increased building height.

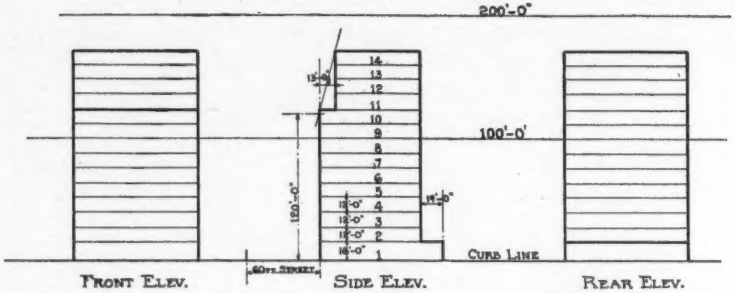
Every building may cover the entire lot up to the top of the first story. Above such first story ten per cent of every interior lot must be left vacant, and except on a lot facing on two or more streets such ten per cent shall be left at the rear of the lot. This will mean, as a rule, that each owner of an interior lot will leave a ten-foot court across the rear of his lot. This ten-foot court joined with the ten-foot court on the adjoining lot will make a minimum space of twenty feet back to back between buildings. An open court of this kind is of great importance to adequate ventilation. No rear court is required in the case of a corner lot.

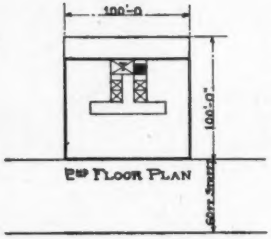
In addition to rear courts or the required ten per cent loss of area there must be a further loss of area covered by the building equal to one per cent of the lot area for each story except the first story. Loss of area occasioned by set-backs of the front walls is included in this one per cent per floor required loss. As the required set-back of front walls on a lot one hundred feet deep means a loss of about three per cent per floor, it is only in the case of buildings of unusual shapes that the one per cent requirement would have any practical effect after reaching the height where the required set-back of street walls begins. This requirement is supplemented by prescribing a minimum dimension proportionate to height for main courts other than the ten per cent rear court. The least dimension of such courts must be not less than six feet, and not less than the number of feet equal to one and one fourth times the number of stories above the first story. At the twenty-first story the court would have to be at least twenty-five feet in each dimension. Such courts are included as a part of the one per cent per floor required loss of area. These requirements apply to a corner lot as well as to an interior lot.

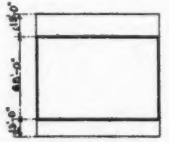
Buildings erected on lots of specified shapes and sizes, and for which it has seemed that adequate light and air can be secured from the streets, are exempted from the requirement as to the loss in area of one per cent per story, and from all requirements as to courts.

As an exception to all the above height and court regulations, a tower may be erected to any height, provided it does not cover more than twenty-five per cent of the lot, and provided every part of the tower is kept at least twenty feet from the lot and street lines. In the case of a building facing a public park or water front, however, such tower may be placed at the building line. Towers of this kind will not interfere with light and air, and while not attractive investments, will probably continue to be built, as in the past, from motives other than for rental return.

For plots of normal size, it is estimated that buildings will reach their economic height when, through the application of the court and set-back







CALCULATIONS

LOT AREA = 100 x 100	= 10000 SQ.FT.	
10% OF 10000	= 1000 " "	
1% " "	= 100 " "	PER FLOOR.
LOSS OF AREA 2ND FLOOR	= 1100 " "	
" " -(100FT.) 9TH "	= 1800 " "	
" " " 11TH FLOOR	= 3200 " "	
14TH FLOOR:-		
REQUIRED BY 1% + 10%	= 2300 " "	
FACADE REDUCTION	= 1300 " "	
REMAINDER FOR COURT	= 1000 " "	

1.25 x 14 = 17'-6" LEAST DIMENSION OF COURT.
AREA OF BUILDING AT 14TH FLOOR = 68% OF LOT.

TYPICAL BUILDING
ON INTERIOR LOT
FRONTING ON A 60FT. STREET.

SCALE:- 0 20 40 60 80 100 DATE: NOV. 11, 1913.
DRAWN BY A.E.H.

regulations, the area of the building has been reduced to about sixty per cent of the area of the plot. This will mean that for buildings on an interior plot on a sixty-foot street, the economic height limit will be about fourteen to seventeen stories. On a corner plot on a hundred-foot street, the economic height limit will be probably sixteen to twenty stories.

The proposed regulations are in full as follows :—

Street Walls.

1 A. Except as hereinafter provided, when the street walls of any building reach a height equal to twice the width of the street, they shall be set back from the street in the ratio of one foot horizontally for each four feet vertically, but the street walls of a building facing on any street, public place, park or body of water, more than 150 feet wide, including an intervening street, if any, must begin their set-backs not over 300 feet above the curb except as hereinafter provided for towers.

1 B. Street walls, if erected on the building line, may reach the height of one hundred feet on a street less than fifty feet wide before the set-back, as stated above, must begin.

1 C. When the width of a street varies in a given block, the width of the street, for the purpose of determining the height of the street walls in said block, shall be taken to mean the average width of said street in said block.

2. When street walls are erected inside the building line, so that a space intervenes between the street and the wall, the set-back shall begin where such wall intersects the set-back plane, as determined by the set-backs in paragraphs 1 A and 1 B, and above that point the wall shall set back in the same manner as if the wall were placed on the building line.

3. Where a single building is erected upon a corner lot facing upon streets of different widths, the street of greatest width may be used to determine the height at which the set-back shall begin. The mean level of the curb in such street of greatest width shall be the point from which such height shall be measured.

4. Where a single building not on a corner lot abuts upon streets of different widths, the height and set-backs of each street wall shall be determined by the width of the street on which it abuts.

5. No cornice shall project more than five per cent of the width of the street beyond the building line or the plane determined by the required set-backs in 1 A and 1 B.

Courts.

6. Every building may cover the entire area of the lot up to and including the tier of beams forming the ceiling of the first story, which shall be that story the floor of which shall be not more than seven feet above the curb level at the highest point of any street on which the building abuts.

7. Except as hereinafter provided, on all lots upon which buildings shall be erected, provision for light and air shall be made by leaving yards or uncovered courts above the second story floor level whose least dimension shall be not less than six feet.

8. At any story of a building the least dimension of any court, measured to an opposite wall of the same building, or to a lot line, shall equal in feet at least one and one-fourth times the number of stories from the second floor to and including said story. This provision need not apply to a rear yard, as required under paragraph 12.

9. In a court of irregular shape the least dimension shall be taken to mean the least distance between walls or between any wall and a lot line measured on a line erected perpendicular to the center of any side of said court.

10. The provisions of paragraphs 7, 8 and 9 need not apply to a court upon which no office or workroom solely depends for access to outside light and air.

11. In every building there shall be a loss in area for each story above the second story floor level of at least one per cent of the lot area, in addition to other requirements hereinafter contained.

12. Except as provided in paragraphs 13 A and 13 B there shall be an uncovered space above the second story floor level between the rear line of every building and the rear line of the lot, which shall contain not less than ten per cent of the area of the lot, and the least dimension of which shall be not less than ten per cent of the depth of the lot. When the front and rear lines of the lot are not parallel, the depth of the lot shall be taken to mean the average depth.

13 A. The requirements of paragraph 12 shall not apply to a building erected on a lot at the corner of two or more streets.

13 B. When a building is erected upon a lot fronting upon two or more streets, but not on a corner, there shall be an uncovered space above the second story floor level equal in area to ten per cent of the area of the lot.

14. No courts shall be required in a building erected on a three-sided lot in which three sides face upon public streets and in which the length of the shortest side does not exceed one hundred feet.

15. No courts shall be required in a building erected upon a three-sided lot in which only two sides face upon public streets and in which the length of the third side does not exceed one hundred feet.

16. No courts shall be required in a building erected upon a rectangular or trapezoidal lot in which three or more sides face upon public streets, and in which the greatest width of the lot from street to street measured in a line at right angles to either street does not exceed ninety feet.

Towers.

17. It is further provided that, in addition to a building erected as hereinbefore provided, a structure to be called a "tower" may extend without limit above such building and without loss of area, but such tower shall not occupy an area exceeding twenty-five per cent of the area of the lot, and no part of such tower shall approach nearer than twenty feet to any lot or street line, except, however, that such tower may be built on that building line of a building facing on a public square, a public park or the water front, with or without an intervening street, as hereinbefore defined in paragraph 1 A.

Exceptions.

18. The above regulations do not apply to tenement houses and do not apply to hotels, lodging houses or theatres in so far as sections 6–16 in relation to courts are concerned, nor do they apply to church spires, belfries or chimneys for power and manufacturing plants. The existing laws and ordinances in relation to tenement houses and hotels, lodging houses and theatres will be continued in force.

Districting.

Height Regulation Districts.

The Commission believes that any complete system of height and court restriction necessitates the application of different regulations to different parts of the city. The city should be divided into districts, and the restrictions for each district worked out with reference to the peculiar needs and requirements of that particular district. The blanket restrictions which we have recommended for immediate adoption have, as a matter of fact, been devised with reference to the needs of the downtown office and financial district—the area of maximum congestion. They have been

worked out with a view to securing as much light, air, relief from congestion and safety from fire as is consistent with a proper regard for the business requirements and existing land values in this area of maximum congestion. They are so liberal as to be of practically no force in controlling actual building development except in very limited areas throughout the entire city. We believe that the needs of each district should be studied in the same way that we have studied the central office and financial district, and restrictions worked out that will best serve the peculiar needs of each district.

Every city becomes divided into more or less clearly defined districts of different occupation, use and type of building construction. We have the central office and financial district, loft districts, water front and industrial districts, retail business districts, apartment house and hotel districts, tenement house districts, private dwelling districts. The character of building appropriate for each district is of course dependent on the character of occupation and use in that particular district. A comparatively high degree of concentration is believed to be important for the facilitation of business in the office and financial district. Certain trades and industries require structures of unusual size or shape. The demand for housing varies with the differing tastes and necessities of the inhabitants of the city. There is a demand for hotels and apartment houses as well as for single family dwellings. Moreover, advantage of location and the resulting enormous difference in land values tend strongly toward differentiation in the character and intensity of use, and this and other social and economic factors tend toward a natural segregation of buildings according to type and use. The city is divided into building districts. We believe that these natural districts must be recognized in any complete and generally effective system of building restriction.

Height and court restrictions should be framed with a view to securing to each district as much light, air, relief from congestion and safety from fire as is consistent with a proper regard for the most beneficial use of the land, and as is practicable under existing conditions as to improvements and land values. The restrictions should be based on the theory that, assuming that the entire district should be built up uniformly with buildings of the maximum height and extent allowed, the provision for light and air would be adequate, and the district as a whole would be appropriately improved. The varying district restrictions should also have in view the safeguarding of existing and future investments, and the encouragement of an appropriate and orderly building development, by conserving the existing type and character of the district, and by preventing the taking from an existing structure of its minimum allotment of light and air.

While we know of no immediate practicable remedy for the existing congestion of population on the lower East Side, we believe that by appropriate restrictions varying with the district, we can prevent the repetition of these conditions in other parts of the city. A few comparatively small districts of the city are already spoiled, but most of the area of the city is still in condition to be greatly helped by appropriate regulations.

Such restrictions should secure safety from fire, promote public health and convenience and provide adequate light, air and access. The Board should pay reasonable regard to the character of the buildings existing in each district, the present use of the land and its value based on such present or presently expected use. Restrictions thus imposed would promote the most desirable use of the land of each district, and would conserve the value of buildings and enhance the value of land throughout the city.

Killed by a Fire Door.

A most unusual accident, resulting in the death of a watchman, is reported by Mr. David S. Beyer of our committee on Safety to Life, who kindly furnishes the photograph reproduced herewith illustrating the cause of the fatality.

A small piece of pipe was accidentally dropped underneath the door. As the watchman went to close it the door evidently ran down on this pipe which was just sufficient to lift it off the rollers at the top. The watchman tried to hold it, but it was too heavy for him and he fell face downward with the door on his back. While the weight of the door was not sufficient to crush him, he was evidently so stunned or paralyzed as to be unable to help himself and was dead when found by the next watchman on his succeeding round.

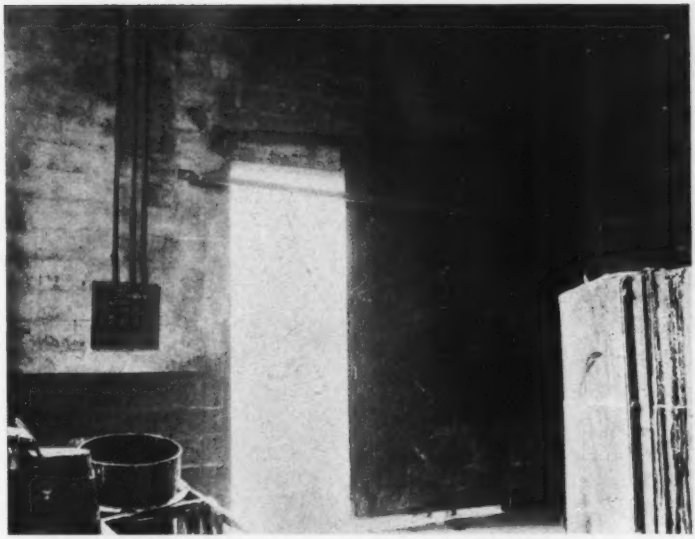
Commenting on the accident, Mr. Beyer says:—

The misplacement of a fire door in this way might involve not only an accident to the person who happened to be manipulating it, but it might open up a building to the spread of flames.

I do not remember having ever seen any safeguard intended to prevent such an occurrence on fire doors, although I have seen guard rails placed on rolling doors used for stables, etc.

The bar across the door which will be noted in the picture was installed after the accident and of course it would prevent a similar occurrence in the future. Some such protection might be placed immediately over the rollers; it might even be embodied as a permanent part of the track on which the roller runs, so that the rollers would only enter from the ends.

The designers of the N. F. P. A. standard fire door anticipated such possibilities, not so much from the standpoint of injuring or killing people, as of the door jumping off of the track, and leaving the opening unprotected. The groove in the wheels of the standard fire door hanger is something like three-quarters inch deep, and the amount of clearance between the under side of the track and the top of the door is generally about one-quarter inch. This automatically prevents the door jumping off the track and it is particularly necessary because, in time of fire, the hardware may heat, and the door may warp and twist, and try to rise off the track.



Fire door causing fatality. The small pipe causing the accident lies in the doorway,

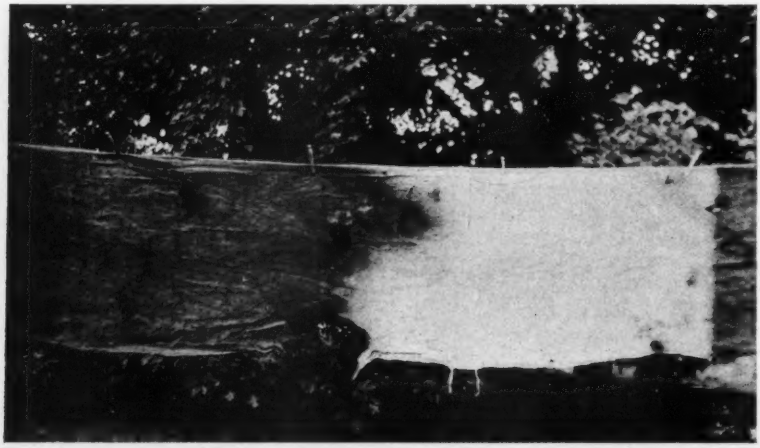
Mr. H. W. Forster, chairman of our committee on Safety to Life, has this to say in reference to the accident reported by Mr. Beyer:—

Where a door is so installed that the distance between the underside of the track and the top of the door is more than the depth of the wheel grooves, we recommend screwing a heavy stud into the vertical part of the hanger, and just barely clearing the underside of the track. The bar which has been placed across the door opening in the case quoted should of course answer fairly well if properly installed, but it would seem to be unnecessary if other provisions have been properly made.

Spontaneous Combustion in Burlap.

The following authentic report of a fire in burlap, caused by spontaneous combustion, is of especial interest in view of the very few instances where fires have been known to occur in burlap from this cause :—

The piece of burlap shown in the photograph was one yard wide, four yards long, and had been folded in four layers and placed on top of a wooden box in the basement of a residence. There was nothing in the box to burn and absolutely no opportunity for ignition, except from an incendiary or spontaneous ignition. The maid smelled smoke, hurried to the basement and found the burlap smoking and burning at one edge. She extinguished the fire with part of a pail of water. This burlap a week before had been removed from the garden where it had been used to cover seeds against the direct rays of the sun. When put into the basement it was presumably dry, and a week elapsed before fire broke out.



Burlap Showing Holes Burned by Fire Due to Spontaneous Ignition.

Field Tests of Dry Pipe Valves.

By Albert Blauvelt (Member N. F. P. A.).

Automatic sprinkler protection in unheated buildings must necessarily be dry-pipe equipment, and, as the writer views it, there is little or no commercial disadvantage shown by the results of dry-pipe equipment as compared to wet-pipe equipment. Wet-pipe equipment, as field practice goes, is severely affected by frost, as shown by the experience of companies writing sprinkler leakage; also as evidenced at length in special papers, such as by the Canadian Fire Underwriters' Association, and also by Mr. Richards, both in the QUARTERLY of April, 1914.

Taking up such of the shortcomings of dry-pipe equipment as are to be found in and of the dry-pipe valve itself, the Western Factory Insurance Association, with assistance from state and large city bureaus in the central west, has made a large number of field tests, with a view not alone to observing the field test action of dry-pipe valves, but also to take notice of the interruption of sprinkler service due to the troubles and failures of attempts at resetting.

A large number of special letters have been received, and these, together with the test results proper, indicate as follows:—

1. Ease of setting and simplicity of instructions are of leading importance. The instruction cards furnished by the manufacturers are overcomplicated, both in the illustration and the text. The property owner often regards the resetting of a dry-pipe valve as a formidable undertaking.

2. Any set sequence of steps in the setting of dry-pipe valves is unimportant. The advantages and disadvantages of closing or not closing the valve before air or water is put on appears to be about alike.

3. High-water pressure is of slight advantage; it has almost no effect on many dry valves, and does not bar failure with any type of dry valve.

4. The trend of dry-pipe valve failures does not clearly point to long standing as a cause. Failures appear to be about as frequent with valves set but a comparatively short time as those set a comparatively long time. Many cases of sharp and thoroughly satisfactory tripping were noted despite the valves having remained untripped for years.

5. If a dry-pipe valve shows a logy action, or fails, it is not a cure to

clean and reset the valve. A sluggish action or a failure may be again expected, if not in the same valve, at least in the same equipment within a comparatively short time.

6. The bursting of dry-pipe valves from "back slap" is not due to reseating of the internal checks. It is due to the castings being inferior to standard cast-iron pipe.

7. Valves found gagged, or with cover plates left open, have become so very infrequent as to indicate that the approved list valves are very satisfactory on these two points.

8. Valves having an air seat in an external pot or trip chamber suffer more from mistreatment, grease priming, insertion of rubber gaskets, etc., than valves having the air seat so located as to be kept primed by the normal condensation of the system.

9. Failures through sticking do not usually appear to be due to silt or corrosion, and are very obscure, the indications pointing toward defective manufacture.

10. Improvement in shop practice is more clearly indicated as needful, rather than to resort to any radical change in the way of increased frequency of field tests.

The field experience from which the above deductions are drawn covers all classes of protected risks in the Central West, and is illustrated by the subjoined table of 1,354 field tests, nearly all of which were made during the current year.

Report.	Number of Valves Tested.	Action.	Remarks.
1	2	Sharp.	Set more than one year.
2	20	Sharp.	No unusual conditions.
3	1	Feeble.	Air all gone, barely released.
4	28	Sharp.	Large batch of old valves.
5	35	Good.	No unusual conditions.
6	4	Sharp.	Set "several years."
7	1	Dead.	Set three years, failed at first, later tripped.
8	19	Sharp.	No special features.
9	7	Sharp.	Set two to three years.
10	11	Sharp.	No notable conditions.
11	4	Sharp.	All conditions normal.
12	2	Sharp.	No comment.
13	22	Sharp.	No criticism.
14	9	Sharp.	Normal action.
15	23	Sharp.	Six of the twenty-three made water damage.
16	10	Sharp.	No special conditions.
17	1	Slow.	Set three years; almost failed despite high pressure.
18	9	Sharp.	No special conditions.
19	6	Sharp.	All conditions normal.
20	9	Sharp.	No criticism.
21	3	Fair.	Leaky, poor materials, one crack.
22	8	Sharp.	No comment.
23	2	Dead.	Very logy, barely let go.
24	1	Dead.	All air gone, barely released, stuck once earlier.
25	15	Good.	No comment.

Report.	Number of Valves Tested.	Action.	Remarks.
26	10	Poor.	Rings ruptured. some water damage.
27	12	Sharp.	All conditions normal.
28	2	Poor.	Rings ruptured.
29	4	Sharp.	No comment.
30	1	Dead.	Failed from water column.
31	21	Sharp.	No unusual conditions.
32	38	Sharp.	No criticism.
33	20	Sharp.	Normal action.
34	1	Sharp.	Set for about two and one-half years.
35	11	Sharp.	No comment.
36	2	Stuck.	Double failure, purely mechanical.
37	24	Good.	No comment.
38	5	Sharp.	One valve made water damage.
39	18	Good.	All conditions normal.
40	18	Sharp.	No comment.
41	1	Failed.	Screwed hand hole blew out.
42	5	Sharp.	No comment.
43	2	Sharp.	Set more than one year.
44	11	Sharp.	All conditions normal.
45	1	Sharp.	Set more than one year.
46	4	Sharp.	No comment.
47	1	Sharp.	Set for four years.
48	26	Good.	No special comment.
49	2	Sharp.	No comment.
50	1	Failed.	Set two years and stuck.
51	2	Sharp.	No notable conditions.
52	249	Good.	Normal action tests by Member Henley.
53	1	Failed.	Stuck, no apparent cause.
54	35	Sharp.	All normal.
55	29	Good.	All normal.
56	2	Good.	Set for three years.
57	2	Sharp.	No comment.
58	3	Good.	Set more than three years.
59	4	Good.	All normal.
60	4	Dead.	Air wholly released, valves barely tripped.
61	1	Failed.	Failed by sticking.
62	38	Good.	All normal.
63	1	Failed.	Burst, new valve, no sufficient cause.
64	3	Sharp.	All normal.
65	1	Failed.	Stuck because primed with thick grease.
66	1	Sharp.	Normal action.
67	91	Good.	Varied 5 to 28 pounds trip point. Conditions alike.
68	2	Failed.	Burst, new valves, no sufficient cause.
69	3	Good.	No comment.
70	1	Failed.	Because capable of being mis-set.
71	1	Good.	Set more than one year.
72	11	Sharp.	No comment.
73	1	Failed.	Stuck and stuck once earlier.
74	1	Good.	Normal action.
75	1	Failed.	Burst, new valve, no explanation.
76	2	Sharp.	No criticism.
77	1	Failed.	Burst, no valve, no explanation.
78	1	Failed.	Valve had been abused.
79	7	Good.	Trip point very variable.
80	14	Sharp.	No criticism.

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5	35	Good.	No unusual conditions.
6	4	Sharp.	Set "several years."
7	1	Dead.	Set three years, failed at first, later tripped.
8	19	Sharp.	No special features.
9	7	Sharp.	Set two to three years.
10	11	Sharp.	No notable conditions.
11	4	Sharp.	All conditions normal.
12	2	Sharp.	No comment.
13	22	Sharp.	No criticism.
14	9	Sharp.	Normal action.
15	23	Sharp.	Six of the twenty-three made water damage.
16	10	Sharp.	No special conditions.
17	1	Slow.	Set three years; almost failed despite high pressure.
18	9	Sharp.	No special conditions.
19	6	Sharp.	All conditions normal.
20	9	Sharp.	No criticism.
21	3	Fair.	Leaky, poor materials, one crack.
22	8	Sharp.	No comment.
23	2	Dead.	Very logy, barely let go.
24	1	Dead.	All air gone, barely released, stuck once earlier.
25	15	Good.	No comment.

Report.	Number of Valves Tested.	Action.	Remarks.
26	10	Poor.	Rings ruptured. some water damage.
27	12	Sharp.	All conditions normal.
28	2	Poor.	Rings ruptured.
29	4	Sharp.	No comment.
30	1	Dead.	Failed from water column.
31	21	Sharp.	No unusual conditions.
32	38	Sharp.	No criticism.
33	20	Sharp.	Normal action.
34	1	Sharp.	Set for about two and one-half years.
35	11	Sharp.	No comment.
36	2	Stuck.	Double failure, purely mechanical.
37	24	Good.	No comment.
38	5	Sharp.	One valve made water damage.
39	18	Good.	All conditions normal.
40	18	Sharp.	No comment.
41	1	Failed.	Screwed hand hole blew out.
42	5	Sharp.	No comment.
43	2	Sharp.	Set more than one year.
44	11	Sharp.	All conditions normal.
45	1	Sharp.	Set more than one year.
46	4	Sharp.	No comment.
47	1	Sharp.	Set for four years.
48	26	Good.	No special comment.
49	2	Sharp.	No comment.
50	1	Failed.	Set two years and stuck.
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55	29	Good.	All normal.
56	2	Good.	Set for three years.
57	2	Sharp.	No comment.
58	3	Good.	Set more than three years.
59	4	Good.	All normal.
60	4	Dead.	Air wholly released, valves barely tripped.
61	1	Failed.	Failed by sticking.
62	38	Good.	All normal.
63	1	Failed.	Burst, new valve, no sufficient cause.
64	3	Sharp.	All normal.
65	1	Failed.	Stuck because primed with thick grease.
66	1	Sharp.	Normal action.
67	91	Good.	Varied 5 to 28 pounds trip point. Conditions alike.
68	2	Failed.	Burst, new valves, no sufficient cause.
69	3	Good.	No comment.
70	1	Failed.	Because capable of being mis-set.
71	1	Good.	Set more than one year.
72	11	Sharp.	No comment.
73	1	Failed.	Stuck and stuck once earlier.
74	1	Good.	Normal action.
75	1	Failed.	Burst, new valve, no explanation.
76	2	Sharp.	No criticism.
77	1	Failed.	Burst, no valve, no explanation.
78	1	Failed.	Valve had been abused.
79	7	Good.	Trip point very variable.
80	14	Sharp.	No criticism.

Report.	Number of Valves Tested.	Action.	Remarks.
81	1	Failed.	Hand hole blew out
82	20	Good.	No notable conditions.
83	6	Fair.	Bad variation of trip point. Conditions alike.
84	10	Sharp.	All normal.
85	3	Good.	No comment.
86	1	Failed.	Set over a year, failed and later burst.
87	31	Good.	No criticism.
88	1	Dead.	Released tardily, thick grease priming.
89	2	Sharp.	Set more than five years.
90	1	Sharp.	No comment.
91	1	Failed.	Burst on inspection test.
92	1	Failed.	Burst on test stand in repair shop.
93	9	Good.	No notable conditions.
94	2	Sharp.	No comment.
95	1	Failed.	Stuck, no adequate explanation.
96	18	Sharp.	No criticism.
97	1	Dead.	Hung fire, then barely released.
98	31	Good.	Includes some set for three years.
99	1	Failed.	Completely stuck.
100	9	Good.	All normal.
101	41	Good.	All normal.
102	4	Sharp.	Set more than one year.
103	13	Good.	No criticism.
104	4	Sharp.	Set two to four years.
105	16	Good.	In part set for at least a year.
106	5	Sharp.	No notable conditions.
107	6	Sharp.	Set for two and three years.
108	1	Bad.	Upper check cracked.
109	5	Good.	Set one and two years.
110	1	Bad.	Leaked a flood.
111	20	Good.	No criticism.
112	1	Dead.	Logy and almost failed.
113	2	Failed	Double failure, valves stuck.
114	1	Sharp.	Normal.
115	1	Failed.	Stuck and stuck once earlier.
116	1	Good.	No comment.
117	1	Failed.	Stuck.
118	13	Good.	All normal action.
119	13	Sharp.	No criticism.
120	1	Dead.	Feeble action, far below normal.
121	18	Sharp.	No notable conditions.
122	1	Bad.	Logy and tripped far below normal.
123	29	Sharp.	Includes some set for three years.

Department of Fire Record.

Laundries—Fire Record.

The present methods of living show a growing tendency to decrease the amount of cooking, washing, sewing, etc., done in the homes. This has naturally resulted in a rapid increase in the number of laundries and the variety of their work, so that a study of the fire record of laundries at this time is of especial interest.

The number of fires reported is not very large, but nevertheless sufficient to bring out many points worthy of note. The proportion of the various common causes does not differ greatly from many other classifications except for the rather large number of fires due to boilers and flues. This may be easily understood when the important part that heat and hot water have to play in the operation of a laundry is considered. The record for special hazard causes very clearly brings out the danger of the dry room, since 25.5 per cent of all known causes are chargeable to this source. It is evident that the dry room should be constructed in the best possible manner to prevent fires starting therein, and, further, it should be cut off from the remainder of the laundry.

Although this record does not include dry cleaning establishments, apparently gasoline is used a great deal around the ordinary laundry and consequently is responsible for 10.2 per cent of the fires. The remaining distinct special hazard in laundries seems to be that of pressing irons. Both gas and electric irons frequently cause fires because some operator is careless and neglects to turn them off when leaving work. A main cut-off for both electric and gas, which could be opened each night, would seem to offer a remedy for this class of fire.

It is particularly interesting to compare the losses in all laundries with those equipped with automatic sprinklers. The percentage of large losses (that is $5,000 or over) in laundries with sprinklers is only 3.5, while in all laundries it is 28.7; or if we consider only laundries without automatic sprinklers, this figure reaches the surprisingly large percentage of 34.8. Surely no better argument is needed to prove the wisdom of installing an approved system of automatic sprinklers in laundries. The fact that 64.5 per cent of these fires occur at night means that they usually have made

good headway before discovery. Over one-half of them were discovered by an outsider. The actual results where sprinklers were installed show that the latter may be depended upon either to extinguish or hold in check with a small loss most of the fires in such properties. The average number of heads opening was only 5.31.

In conclusion, the hazards of boilers and flues, dry rooms, gasoline, and pressing irons, are again emphasized as the ones needing especial attention in laundries. All of these may be safely met by an approved automatic sprinkler system, when maintained in proper order.

Laundries—Fire Record.

Total Number of Fires Reported 167.

1. CLASSIFICATION OF CAUSES.

Summary.

Common Causes.

	No. of Fires.	Per Cent of Common Causes.	Per Cent of Known Causes.
Lighting	5	11.6	5.1
Matches	4	9.3	4.1
Smoking	5	11.6	5.1
Rubbish and Sweepings	3	7.0	3.1
Oily Material	2	4.6	2.0
Locomotive Sparks	1	2.3	1.0
Boiler and Fuel	11	25.6	11.2
Chimneys and Flues	3	7.0	3.1
Heating	3	7.0	3.1
Sparks	3	7.0	3.1
Miscellaneous	3	7.0	3.1
Total	43	100.0	

Special Hazard Causes.

	No. of Fires.	Per Cent of Special Hazards.	Per Cent of Known Causes.
Unknown in Dry Room	13	27.6	13.3
Overheating of Dry Room	7	14.9	7.1
Clothing becoming ignited in Dry Room	5	10.6	5.1
Match in Dryer	1	2.1	1.0
Gasoline	10	21.3	10.2
Pressing Iron	8	17.1	8.1
Miscellaneous	3	6.4	3.1
Total	47	100.0	

	No. of Fires.	Per Cent of Known Causes.
Common Causes	43	44.0
Special Hazard Causes	47	47.9
Incendiary	5	5.1
Exposure	3	3.0
Total Known Causes	98	100.0
Unknown Causes	69	
Total	167	

Details of Causes.

Under this heading are given brief descriptions of fires caused by unusual conditions, or which are of an educational value in emphasizing different hazards. Fires caused by ordinary conditions or well understood hazards may not be included.

S-6675. This fire was caused by defective wiring, the drip loops being short and the porcelain tubes leading the wires into the building were so arranged that water found its way inside. A short circuit resulted and the exposed woodwork was ignited, burning inside the sheathing

S-9778. Fire originated in non-standard laundry dryer on the fourth floor. Dry closet was of frame construction lined with large sheets of galvanized iron, nailed on. Nail heads were exposed. Fire was caused by the carbonization of woodwork, and fire was completely held in check by the opening of one sprinkler head over dry room.

S-9805. A gas stove was connected to overhead gas light burner by rubber hose. Hose caught fire near to stove because of leak, and ignited a pile of shirts nearby.

Only permanent metal piping should be used in making gas stove connections.

S-10222. Fire evidently originated among soiled white coats in a wooden box and seemed to have been caused by spontaneous combustion. Some of the coats came from a saloon.

H-5641. A celluloid collar stay in a lady's shirtwaist is supposed to have caught fire from contact with steam pipes.

H-5831. Fire is thought to have been caused by a match left in workman's overalls when washed, which became ignited by the high temperature of the dry room.

H-5961. Fire was due to an overheated woolen padding and apron conveyor on steam heated mangle.

H-6118. Clothing fell on the steam pipes of poorly designed dryer.

H-6409. A smokepipe from the laundry stove in a small hand laundry became overheated and ignited the woodwork where it passed between the ceiling and the roof.

H-7487. A large bundle of washing containing white coats was brought in by a delivery team at night and thrown on a table under wooden stairway. The watchman found the stairway on fire when he came by on his next round. It is supposed that there were matches in the pockets of these coats, which became ignited when the bundle was thrown down.

H-8186. A wagon driver employed by the laundry, who was late with his work on this evening, detected the odor of escaping gas and struck a match to find same, with the result that the whole front of the building was enveloped in flames.

H-8679. The wooden sash of a window located in a division wall which was in contact with rear end of brick-set boiler became ignited by the heat.

H-8805. Steam pipes in dry room were too near woodwork.

H-9480. Lint on machinery caught fire from kerosene oil torch used by an employee.

H-9528. Fire was apparently due to an explosion of gas caused by someone carelessly opening a gas jet, the gas being ignited by pilot lamps.

H-9746. Heat for dry room was furnished by a system of steam pipes running from the floor up the side wall. Evidence seems to show that in some way the wooden walls became ignited from these pipes.

S-10327. Fire occurred in a storeroom containing a large number of laundry packages wrapped in paper, resting on tiers of shelves. The room is lighted with enclosed gas mantle arc lights, suspended from the ceiling. One of the lamps was immediately above a shelf holding some wrapped stock, and it was at this point the fire occurred. It is supposed that either a globe broke and allowed the heated mantle to drop on the paper, or that the globe was hot enough to ignite the paper by coming in contact with it.

S-10424. A metal flue which was in poor condition had been placed along the ceiling of boiler room against the floor joist, without any protection. A metal sheathing underneath had concealed the presence of the flue.

S-14085. The breeching or flue from high pressure boilers was located two to four inches below corrugated sheet iron which covered floor joists. A seven-eighths inch tongued and grooved flooring was laid on the joists. This whole construction tended to bank the heat over the smoke flue until the joists became charred and ignited.

S-14463. Fire started at 7.30 p. m. in the ironing room and is believed to have been caused by a hot iron being left on the cloth-covered table instead of on the iron stand.

H-1835. Fire originated under wrapping counter where pile of waste paper and sweepings had been allowed to accumulate.

Good housekeeping will prevent many fires.

H-2223. Natural gas escaped from pipes, and as the room was closed for the night it did not have an opportunity to leave the room. Shortly after starting work an explosion occurred which set fire to the building and fatally burned one person.

H-2556. Dry room was constructed of light rough boards and heated by steam pipes and smoke conduit from boiler furnace. There were no guards to prevent clothes from coming in contact with this smoke flue, which ignited them and resulted in a total loss of laundry.

H-2608. Fire started from an electric iron left on ironing board with current on.

H-2679. The collar machine was heated by gasoline which flowed by gravity to the machine. The fire was caused by the explosion of the gasoline tank shortly after starting work in the afternoon, and it is evident that an over-supply of gasoline was ignited in the collar machine and followed back to the tank.

H-3219. Fire was caused from spontaneous combustion in lignite coal used for fuel and stored in rear of building.

H-5063. Fire took place in the dry room which was heated by two large cylindrical coal stoves located near side walls but not clear of the material hanging above. It is supposed that the fire either resulted from spontaneous combustion among the imperfectly cleaned clothing or else from some material falling on the stoves, which had guards over them but not in such a manner as to prevent overheating of any material that might fall on the guards.

2. MISCELLANEOUS STATISTICS.

Analysis of Losses.

Fires Where Sprinklers Operated.

	Common Causes.		Special Causes.		Unknown Incendiary Exposure.		Total	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
No Claim	2	20.0	..	..	2	20.0	4	14.3
Small Loss	8	80.0	7	87.5	8	80.0	23	82.2
Large Loss	0	..	1	12.5	..	..	1	3.5
Total	10		8		10		28	

Relation Between Effect of Sprinklers and Losses.

	Extinguished.		Held in Check.		Unsatisfactory	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
No Claim	4	26.7	..	..	..	..
Small Loss	11	73.3	11	100.0	1	50.0
Large Loss	..	..	..	..	1	50.0
Total	15		11		2	

All Laundry Fires.

	Common Causes.		Special Causes.		Unknown Incendiary Exposure.		Total.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
No Claim	3	7.0	..	..	3	5.1	6	4.2
Small Loss	33	76.7	27	65.9	36	61.0	96	67.1
Large Loss	7	16.3	14	34.1	20	33.9	41	28.7
Total	43		41		59		143	

3. DAY OR NIGHT FIRES. (Day Fires 6 a. m. to 6 p. m.)

	Common Causes.		Special Causes.		Unknown Incendiary Exposure.		Total.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Day	20	42.6	20	48.8	14	21.9	54	35.5
Night	27	57.4	21	51.2	50	78.1	98	64.5
Total with data given.	47		41		64		152	
No data	4		5		5		14	
Total	51		46		69		166	

4. PLANT IN OPERATION.

	Common Causes.		Special Causes.		Unknown Incendiary Exposure.		Total.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Plant in operation ..	21	45.6	23	63.9	12	20.7	56	40.0
Plant not in operation	25	54.4	13	36.1	46	79.3	84	60.0
Total with data given	46		36		58		140	
No data.....	5		10		11		26	
Total.....	51		46		69		166	

5. HOW DISCOVERED.

	Common Causes.		Special Causes.		Unknown Incendiary Exposure.		Total.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Employee	20	44.4	24	54.6	15	23.5	59	38.5
Watchman	8	17.8	7	15.9	2	3.1	17	11.1
Thermostat	0	..	0	..	0	..	0	..
Sprinkler Alarm...	3	6.7	2	4.5	1	1.6	6	3.9
Outsider	14	31.1	11	25.0	46	71.8	71	53.5
Total with data given	45		44		64		153	
No data.....	6		2		5		13	
Total.....	51		46		69		166	

6. EFFECT OF SPRINKLERS.

	No. of Fires.	Per Cent. of Whole.
Extinguished or practically extinguished fire.....	15	53.6
Held fire in check	11	39.3
Unsatisfactory	2	7.1
Total	28	
No Claim	4	14.3
Small Loss.....	23	82.2
Large Loss.....	1	3.5
Total	28	

7. UNSATISFACTORY SPRINKLER FIRES.

S-14085. This fire occurred in the dry room of a laundry. This room was located over the boiler room and was twenty-one by twelve feet in size. The room was enclosed by a seven-eighths inch tongued and grooved partition on two sides and hollow wood lath and plaster finish on brick wall on other two sides. The floor joists over boiler in boiler room were covered by corrugated sheet iron.

The fire, which was caused by boiler breeching igniting the floor joists, was discovered by the watchman who promptly turned in an alarm. When the fire department arrived, one 212° sprinkler in the dry room was operating, but the water could not reach the fire. The fire department opened up the floor and extinguished fire with hose streams.

Summary: Obstructions to distribution.

S-1684. This property consisted of two buildings of small area, adjoining and communicating with poor iron clad fire doors at direct openings; unprotected windows in main building where exposed by small rear building. The floors were four-inch; stairway enclosed in main building and open in rear building, and frame enclosed elevator in main building. Main building was four stories in height, and rear building three stories. Both buildings had brick walls. They were equipped with automatic sprinklers, supplied by city pressure under ninety pounds pressure, and also a 350-gallon pump taking water from a 9,000-gallon tank. The pump was not used. The rear building was occupied entirely by the laundry, while the main building was used by tenant manufacturers, including a broom factory on the fourth floor.

The cause of the fire is not known. The alarm was given by an outsider, and when the first apparatus arrived the rear building was filled with smoke and apparently afire on all floors. A broken gas pipe made it more difficult to fight the flames.

The rear building was completely destroyed and the top floor of the main building was burned out, about half the roof fallen in, and part of the flooring nearest the rear building had failed. The sprinkler piping in rear building was all destroyed, also all the piping on the top floor of the main building and part of it on the other floor was down. Although there was water on the sprinkler system after the fire, it does not seem as if it could have been turned on when the fire started, otherwise the damage in buildings of such small size and good construction, with good city water pressure, would not have been so great.

Summary: Water probably shut off.

8. POINTS OF INTEREST FROM FIRE REPORTS.

S-4143. This fire occurred in a small closet in a dressing room on first floor. Directly in front of closet and on the ceiling were a sprinkler and thermostat, close together. The thermostat was the Watkins "bomb" or closed case waterproof type, and it failed to operate. After the fire this bomb was found one-half full of water, and on being turned over, it operated properly. The water seals on this thermostat were found to be loose. As this room in the laundry is full of steam most of the time, it is supposed that this steam gradually condensed inside the thermostat case and probably caused the failure of the thermostat to operate.

S-10327. The heat from the burning material opened one sprinkler which extinguished the fire before ceiling above became damaged. As the wareroom was filled with light inflammable material, the fire would have spread rapidly throughout the room and to the wood construction of the building but for the presence and prompt operation of the automatic sprinkler.

S-11688. Fire started in four baskets of clean clothes, probably from a cigarette butt, and was not discovered until the next morning when the water began to leak through the floor.

This fire emphasizes the value of an alarm system in connection with the sprinklers, in which case it would not have been possible for the water to run all night without having been discovered.

H-9765. Fire started in rubbish in the basement near elevator, and the smoke and heat quickly passed up this open elevator shaft, causing considerable damage on the other floors. When the floor gave way it broke a gas pipe and as there was no outside shut-off, the gas fed the flames and increased the difficulty of extinguishing the fire.

H-8186. The flames spread rapidly to the second floor by means of the open stairway and large number of holes for belt openings.

All openings between floors should be so protected as to prevent the direct spread of fire through them.

H-7755. Fire started in the lower part of the boiler room near the floor, where the metal sheathing of the wall had been turned back to install pipe leading from bottom of boiler to out-of-doors. This opening of the metal sheathing exposed the interior of the wall, and being very close to the boiler, doubtless hot ashes or coal came in contact with the woodwork. The manner in which burning took place leaves no doubt as to the point where fire originated.

The fire followed up between two studs to the roof, burning through to the outside in several places and destroying the whole upper portion of the wall for six feet below the eaves, extending from a point directly over the origin of the fire to the front of the building. Following up this wall

the fire got into the second floor and burned considerably in the high part of the pitch roof for about half the length of the building.

H-5641. This fire started in the dry room and was discovered by an employee who ran to the standpipe connection and found that no hose had been provided. In the dry room was a fan to keep the air in circulation, and as the employees were forced to run, they did not have time to close the door or trap to the elevator shaft or stairway. The fan created a draft which quickly carried the fire up through the upper floors.

Trap doors should be arranged to close by the melting of a fusible link.

S-3376. The large table used for marking prevented the water from sprinklers reaching the fire, and it became necessary to use a line from the fire department chemical engine.

Sprinklers should be placed under all wide shelves, tables, etc.

9. NUMBER OF SPRINKLERS OPENED.

No. of Sprinklers Operating.	Extinguished Fire.		Held Fire in Check.		Unsatisfactory.		Total.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
1.....	9	60	4	37	1	50	14	50
2.....	2	13	1	9	..	..	3	10
3.....	1	7	1	9	..	..	2	7
4.....	1	7	..	..	..	..	1	4
5.....	..	..	1	9	..	..	1	4
6 to 9 inc.....	1	7	1	9	..	..	2	7
10 to 24 inc....	1	7	2	18	..	..	3	10
25 to 49 inc....	..	..	1	9	..	..	1	4
50 and over....	..	..	..	..	1	50	1	4
Total.....	15		11		2		28	

Average number of sprinklers opened, not including unsatisfactory, 5.31.

No. of Sprinklers Operating.	No. of Fires.	Per Cent of Whole.
1	14	50
2 or less	17	61
3 or less	19	68
4 or less	20	71
5 or less	21	75
Less than 10	23	82
Less than 25	26	93
Less than 50	27	96
50 and over	1	4

General Fire Record.

H-10087. Motion Picture Film Fire. Construction. Building, which was built in 1894, occupied an area of 10,200 square feet. It was six stories and basement in height, with brick walls supported by steel and iron skeleton; floors were single one-inch on wood sleepers filled between, but not to top, with cinder concrete, on four-inch segmental brick arches, on 10-inch 76½-pound steel I-beams five feet on centers, on 24-inch 240-pound steel I-girders sixteen feet on centers on cast-iron columns. Roof tile on arches and supports similar to floors. Fireproofing webs of beams and upper flanges of girders protected by arch construction; lower flanges of beams unprotected; webs of girders protected by plaster on wire lath nailed to wood strips between flanges; lower flanges of girders protected by plaster on wire lath. Columns unprotected. Floor openings—one stair and two elevator shafts of four-inch tile with wired glass on metal skylights. Stairs are iron with stone treads on iron web plates with open arch to hallways or opening direct to lofts with sub-standard metal covered paneled doors. Double car elevator shaft opens to halls with open iron grille, and where same opens direct to floors grille is covered with sheet iron. Single car elevator opens direct to floors by flat framed iron doors.

Occupancy. Basement—Boiler and elevator machinery rooms, storage of furniture, also carpenter shop; first floor—stock of ladies' and gents' furnishings, retail groceries, five and ten cent store; second floor—motion picture studio, stock of property, painting scenes, etc.; third floor—manufacturing of muslin underwear; fourth floor—a motion picture film manufacturer, also printing and developing films, three drying rooms with nine revolving drying drums, projecting room with two motion picture machines (the latter enclosed in room of sheet metal on iron frame), also chemical room with stock of chemicals for dry plate developing (there being about sixty employees on this floor); fifth floor—concern manufacturing polishing cloth, a chemical company manufacturing sal-eliminant and effervescing salts, stock of seidlitz powders and effervescing salts in cans and bottles, raw stock such as potassium bicarbonate, lithum carbonate, etc.; sixth floor—concern manufacturing phonographs.

How Discovered. Fire, which started on the fourth floor, was discovered by an employee at desk. Several other employees tried to extinguish the fire with hand chemicals and pails of sand, but it spread so rapidly that their efforts had no effect. Watchman then pulled a manual

fire alarm box about fifteen or twenty feet from where fire started; about the same time a civilian pulled the public alarm box.

Origin. An electric drop light hanging from ceiling over an employee's table (used for patching films) was struck by his shoulder and swung against some metal boxes, breaking the globe and setting fire to films on the table. The open windows created a strong draft. The partitions, which were constructed of sheet iron on two by four wood studding, did not confine nor retard the fire to any extent, as all partitions were burned or were knocked down by the firemen. About a dozen employees were on the floor at time of fire and some had difficulty in getting out, due to the thick chocking smoke. As nearly as could be ascertained most of the films were in individual metal cases and placed in single-wall, sheet steel cabinets, some with ventilation slats at top, and stored for the night. When these lockers were finally opened, all films in boxes were reduced to a few ashes, showing that the heat from the exterior had ignited them. The smoke from this fire was very dense and stifling. Employees claim there were no films on drying drums, otherwise fire would have spread still more rapidly. From the fourth floor the fire entered the two floors above through outside unprotected windows.

How Extinguished. Fire was extinguished by the public fire department, which acted promptly after alarm was received, as the nearest fire house was only one block away; but the fire spread so rapidly that the entire block was ablaze when the first apparatus arrived. Three alarms were sent in, calling out a force of twelve engines and four trucks, and fire was extinguished within an hour.

Damage. The entire fourth story was gutted except in corner where developing tanks are located, some of which are charred on outside. The fire damage on the fifth floor was confined to charring of the office furniture and records, etc., and on the sixth floor to a window frame. The stock of salts, including sodium bicarbonate, acid tartaric, sodium phosphate, also seidlitz powders, etc., on fifth was considerably damaged by water; also stock of white goods, motors and sewing machines on third. Floors below third were damaged to some extent by water. The building structure shows no damage other than to plaster and finish by fire on fourth and by water on third and fifth.

Conclusions. The process of developing and printing nitro-cellulose motion picture films is unusually hazardous and should be isolated in a separate building. If permitted in a building with other occupancies, the construction should be fireproof, with standard protection at floor openings. The amount of film in process should be limited to a small quantity in any one room, by sub-dividing with numerous fire-resisting partitions and fire doors. The building should be equipped throughout with automatic sprinklers.

The use of portable electric lamps, also swinging drops, in occupancies of this character is dangerous and lights in rooms where films are stored or handled should be protected by wire guards or vapor-proof globes.

H-10373. This fire was evidently caused by flying brands being blown into rear of opera house from a pile of rubbish. When discovered an effort was made to transmit the alarm to the water plant by telephone, but it was unsuccessful and a messenger was sent to the plant. At the time, the city mains were dry and the engineer was inside one of the boilers repairing it, so that it might be used to operate the electric light plant that night. Only one of the three boilers was in use, and it is doubtful if it would have had sufficient capacity to operate both pumps at full rated capacity. When the engineer received word of fire, both pumps were started, but the mains had scarcely been filled with water when the pumps broke down, due to the heavy duty placed upon them and to broken valves. This left the city without protection, as the fire had gained such headway that chemicals were useless. Fanned by a brisk southeasterly wind it soon communicated to adjoining buildings and, despite intervening streets sixty feet in width, spread to adjacent blocks. Efforts were made to check the flames by volunteer firemen and citizens, dynamite being resorted to, but within four hours of its discovery four blocks in the business district were destroyed, and one man was killed by a falling wall. The fire practically burned itself out.

The buildings destroyed were one, two and three stories in height, chiefly of brick construction, with a few of frame and frame iron clad construction. Brick walls, both independent and party, were largely of inadequate thickness and without standard parapets. Exposed wall openings were without proper protection.

The total loss was approximately $250,000.

The following points suggest themselves:—

(1) Had pumps and boilers been in good repair and an adequate supply of water available, the fire should have been confined to a comparatively small area.

(2) The importance of standard cut-offs between buildings, and the proper protection of exposed openings is emphasized.

(3) The wide streets were shown to have considerable value as fire barriers for fires even of this magnitude.

(4) The burning of rubbish in alleys and streets is always dangerous, and should never be tolerated.

H-10135. This factory was devoted to the manufacture of acetylene gas and was totally destroyed by fire, accompanied by a series of explosions of acetylene gas contained within the apparatus.

Construction. The plant was a small one, consisting of a plank and timber wooden mill about 45 by 60 feet, three stories and attic, the upper story being in a mansard roof and finished with hollow spaces. There was also a space below part of the first floor, of varying height, containing a wheel and tail race. The first story was below the street level on the front, but above grade on all other sides. There was a two-story addition, formerly an engine room, which was built partially of brick. Beyond was

a small one-story brick boiler house, a one-story brick generator room was in the rear, five feet away from mill, and 100 feet northwest was a storage gasometer which was not damaged. There was an open stairway in the main building. The mill was well built, being erected about 1870 for a knitting mill.

Occupancy. The business consisted of generating, purifying and compressing acetylene gas, which was sold in tanks containing about forty cubic feet for automobile use, and 100 to 800 cubic feet for welding. No oxygen was generated, although the building contained apparatus formerly used for that purpose. Four men were employed.

All the work was conducted in the first story, the second being used for storage of empty tanks. The upper floors of the building were practically vacant. The boiler is not used in summer. The tanks were charged in the small addition and in the easterly end of the mill. The west side was used for shipping. An automobile truck is backed inside the building to take the shipments.

Processes. The generator was located in the most northerly compartment of the detached brick building; carbide was stored in 200-pound tins in the next room. The machine was a carbide to water type furnished by the same company from which the carbide was purchased. This was in granulated form with 200 pounds in a can. About six to ten cans were used a day, generating about 5,000 to 8,000 cubic feet.

From the generator a three-inch pipe conducted the gas underground to the storage gasometer located 100 feet from the building. This held about 1,000 cubic feet. From this a three-inch pipe led to a receiving gasometer holding about eighty-five cubic feet, located inside the building. The gasometers were of the ordinary water seal type. Nearby were located the scrubbers or purifiers. There were four of these, consisting of sheet steel tanks about eighteen inches in diameter by four feet high. They were used to desiccate and enrich the gas. The first contained calcium chloride, the two following carbide, and the fourth charcoal. The gas passed through each of these in turn, under slight pressure, from the receiving gasometer, and thence to two triplex power compressors. The piping from the generator to the scrubbers was three-inch. The suctions to the compressors were two and one-half inch.

From the compressors, three-quarter inch pipes were carried about the rooms to the several charging tanks. The piping was ordinary steel. The use of unions was common, and probably no special precautions were taken to make the piping and its supports much superior to ordinary piping. The terminal unions where connecting with the tanks were of brass.

The charging tanks were wooden troughs filled with water, into which the gas tanks were placed when being filled. The water enabled all leaks in tanks to be promptly found. Ice was kept in the tanks to keep the temperature low, so that a greater volume of gas might be put in the tanks than otherwise. The tanks were charged to 225 pounds. In charging the tanks two or more charges were given with intervals between as

they were filled with asbestos fibre which the gas permeated. When removed from the ice water the pressure in the tanks would rise to about 250 pounds in summer. All the tanks were provided with fusible plugs. The small tanks were of copper or bronze, lead or tin lined. The welding gas tanks were of steel. Generating and charging was practically continuous during the day.

Story of the Fire. Minor explosions of gas had not been uncommon in this plant. They were usually mild, resulting in no fire. There was an explosion in the generator room a short time ago. In charging the machine some carbide was spilled upon the wet floor, which resulted in gas being generated which ignited from a loose electric light fixture. No one was injured and no fire ensued. An employee was slightly injured before this in another explosion.

On the morning of the fire, work was being conducted as usual. A battery of tanks was being connected up for charging. Men were loading the automobile truck at the other end of the building. The truck, though inside, was "dead," and had no connection with the start of the fire. It was the custom, however, to run the truck into the building and run it out under its own power, but the door to the charging room was always closed at such times. The generator was in use, and the receiving tank was about half full of gas. The scrubbers and pipe system were full of gas.

The plant starts at 7 a. m. At 7.50 there was an explosion in the south end of the charging room. It was not a severe explosion but was heard for some distance. The man working on the tanks at the other end of this room was slightly burned. He was near a door, by which he escaped. A second employee was in the carbide storeroom and had no difficulty in escaping by way of the generator room. The superintendent and fourth employee were in the shipping room, weighing tanks and loading the truck. They were not injured.

On hearing the explosion the superintendent saw the charging room quite generally on fire. The fire evidently at that time appeared to be mostly burning gas. The superintendent then ran into the yard and shut off the valve at the large gasometer, thus preventing more gas entering the building. This tank with its contents was uninjured.

A second explosion, much more severe, occurred in less than a minute after the first one. The window glass on the north side of the first story was blown out but there apparently was no other injury to the building. The fire chief said that this was not much more severe than an ordinary heat explosion. The whole first story was then on fire. The open stairway led the fire up through the building, which was soon in flames from top to bottom. Explosions occurred rapidly as the several sections of the apparatus blew up, but none of them appeared to damage the building materially. There were ten or twelve explosions. Within forty minutes the plant had burned to the ground. The outside gasometer, outside gasoline tank, water wheel, boiler, chimney and carbide in sealed cans appear to be the only things not destroyed.

Cause of the Fire. The cause of the explosion is not known. It is quite certain that the slight explosion was first, being followed by fire. There was an overhead three-fourths inch gas pipe near the southerly outside door of the charging room which was struck by the door when swung fully open. The superintendent states that probably the wind swung the door forcibly against this pipe, cracking it or breaking it off, thereby permitting gas to escape. There were no fires in the building, and smoking was not allowed. Two electric lamps were burning in the charging room. These had wire protectors but were of the key type. One compressor was run by the water wheel; the other by an alternating current motor with no brushes. Probably the gas was ignited by the keyed lamp sockets, but this is not certain. Gas continued to flow from the apparatus and caused the following explosion. After the fire it was observed that but few of the gas tanks had exploded. The fusible plugs appeared to work properly. The ruptured tanks may have been injured from falling machinery, but some of the steel ones appear to have opened at the seams. The tops of the four scrubbers were blown off and there is a rent in the top of the receiving gasometer. These pieces of apparatus were not badly wrecked. The explosions were evidently mostly due to accumulations of gas escaping from the tanks, pipes and apparatus. As the southerly wall of the first story of the building was a stone retaining wall, more or less of a pocket would be formed for gas to accumulate. There would not be so good a chance for ventilation as if the building were above grade on all sides. It was fortunate that the gasometer was shut off early in the fire, and serious explosions thus avoided.

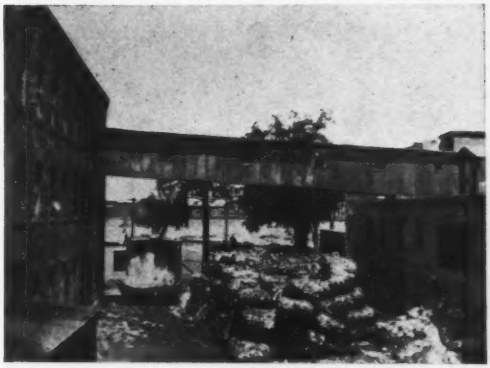
Protection. The plant contained small hose, chemicals and pails, but there was no opportunity to use them. The public alarm was rung in promptly with some confusion, however, as two boxes were pulled; but this caused no delay of the fire department as the location of the fire was known. Two streams were laid to protect surrounding property and the gasometer. The main plant was so soon in flames and the explosions so frequent that no work could be done on the main building.

H-10377. Fire started in a box car in the yard between two factories, probably from carelessness of tramps. The box car stood some four feet from the three-story building on one side, and a large pile of baled waste paper on the other, while on the further side of the paper pile was located a one-story and basement building of a boxboard company. An iron-clad enclosed bridge connected the two buildings and was located directly over the burning car and paper pile.

The fire was discovered in the evening by the watchman, who pulled public fire alarm box. By the time firemen arrived, the fire enveloped the box car and spread over pile of waste paper. The supports of the enclosed bridge, the underside of the bridge and the frames of windows on all floors of the three-story factory and of the boxboard factory were on fire. So threatening was the fire that a special call was immediately sent in for an

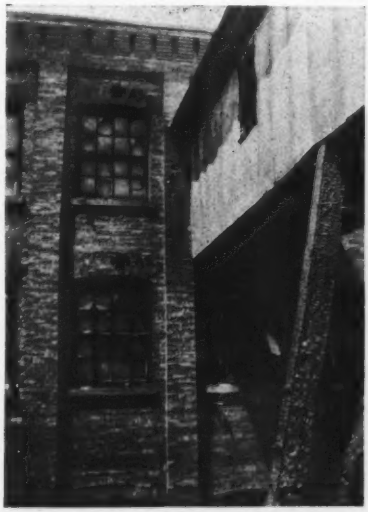
additional steamer and hose wagon. The fire was extinguished, however, before it gained a foothold inside of either building. Although the windows were broken by the heat, sprinklers in the inside materially assisted in preventing the entrance of the fire.

This fire demonstrates that even in the open an accumulation of inflammable material is a decided hazard. The photographs illustrate the ease with which fire attacks the ordinary wooden frame glass window.



H-10377.

Fire started in box car and rapidly spread over paper.



H-10377.

Sprinklers inside these two windows operated and assisted in preventing entrance of flames.

Photos by H. A. Fanckboner.

H-10377.

Effect of severe exposure fire on ordinary windows.

Fires in Which There Was Loss of Life.

These fires are intended to point out conditions under which loss of life occurs, that they may be known and guarded against.

Holocausts which are adequately reported in the daily press or are the subject of special investigation may not be given herein; nor is any complete record of loss of life in fires at present obtainable.

H–10375. This building, one to four stories and basement in height, of ordinary brick construction, was occupied by the Salvation Army as an industrial home with officers' quarters, lodging for working men, rag and paper storage, sorting and baling, furniture repairing and painting, stable, and stock of old clothing and furniture. The stairways in the halls had wooden doors; elevator was enclosed in metal lath and plaster with hand-closing doors.

About ten days previous there was a small fire caused by drying rags on steam pipes. The city inspectors visited this building and ordered the installation of exit lights and signs at halls, also fire escapes, distribution of chemical fire extinguishers, fireproofing of stair halls and removal of rag department and stable from building. None of these orders had been complied with.

Early in the evening fire was discovered in first story and extinguished with slight loss. About midnight watchman passed through rag department on first floor. A few minutes later he smelled smoke and returning to rag department discovered fire in paper bin. He ran throughout the building and aroused the inmates. Several lodgers, however, state that they were aroused by the smell of smoke instead of by the watchman.

No attempt was made to use interior hose system, and the city department, which responded promptly, was hampered in fighting the fire by the necessity of rescuing inmates. There were ninety-three person in the building when fire occurred. One officer was found suffocated in the office on first floor and four lodgers were found dead in upper stories. No attempt was made to rescue twelve horses in the basement, and these were all killed.

This fire is similar to many other fatal fires which have occurred in lodging houses of this class. The need of better construction together with adequate exits is again emphasized.

The Grand Trunk Pacific Dock Fire, Seattle, Wash., July 30, 1914.

Construction. This dock was entirely of frame construction and stood upon open creosoted piling. The center line of the warehouse was approximately 500 feet long and 105 feet wide. The peak of the roof was fifty-five feet above the floor. At the northwest corner of the warehouse was a frame tower 115 feet high. Between the warehouse and Railroad Avenue was a wooden building 100 feet long and three stories high, which was used for office purposes. It was cut off from warehouse by double plank partitions and rolling steel fire doors, which proved of considerable value in saving the office portion. Along the north side of the warehouse was a wharf sixteen and one half feet wide, also an eight-foot wharf on the south side. These were continuous. To the north was Pier No. 3, the Galbraith-Bacon warehouse, 114 feet away, with the city fireboat dock in between. To the south was the Colman dock, 167 feet away, with the short West Seattle ferry landing between. The office portion of the Grand Trunk property was much wider than the dock itself, and so the large frame buildings were practically without a break from the north line of the Grand Trunk at Madison Street, two blocks south, to Columbia Street, along the westerly side of Railroad Avenue.

Weather Conditions. The temperature during the afternoon of the fire was 80° F., and the wind from six to seven miles per hour from the north and northwest. The tide was low at 4 p. m.

Story of the Fire. About 3.30 p. m., on Thursday, July 30th, the steamers Athlon and Admiral Farragut lay at the south side of the Grand Trunk dock, the former near the southwest corner. A most careful investigation has as yet failed to indicate that there were any inflammable oils or explosives near these steamers. Several persons who were looking out from the windows of the Colman dock, just opposite, shortly after 3.40 p. m., saw black smoke suddenly rise from the wharf side of the Athlon. All those on this boat agreed that the smoke came from under the floor, apparently from a point directly north and fifty to sixty feet away. A strange feature is that no smoke rose from the cracks in the planking floor. The engineer of the steamer testified at the coroner's inquest that he ran into the warehouse and gave the alarm to those inside, and on returning as quickly as he could, he found flames coming from under the string piece of the wharf toward his boat. At this time most of those watching from a distance thought that the Athlon was on fire and the side of the boat was considerably scorched.

There was no provision for giving alarm of fire from the inside of warehouse. The only sprinkler system was the one installed in the Galbraith-Bacon dock, which was a large factor in the saving of that building. On hearing the cry of fire, the Grand Trunk Dock engineer ran to one of the north doors near him and called to one of the firemen at the fireboat station. This company responded with an auto hose wagon at 3.46 p. m. The dock engineer in the meantime ran back to the door where

Grand Trunk Dock Fire, Seattle, Wash.

All the streams shown are from fire boats. Photo from H. W. Bringhurst.

the Athlon lay and looked over the wharf. He stated that at that time fuel oil was burning on the surface of the water and that the flames were coming up between the dock and the side of the vessel. Others declared as positively that the flames were not near the water but simply under the floor.

The firemen arrived and attached their hose to a hydrant just outside the dock on Railroad Avenue and unreeled approximately 700 feet. As they entered the door there was no fire nor smoke in sight, but men were seen getting down the dock hose in the southwest corner. As they approached, a thick, black smoke was seen rising through the floor and there was much fire rolling up outside the door. When the wagon was stopped, the smoke was so thick that the men could scarcely see to put on the nozzle. Both of the streams in use had good pressure but did not seem to produce any effect upon the flames which the firemen say were coming from underneath, through the cracks in the four-inch floor. The lieutenant in charge of this company ran to a telephone on the dock and gave the regular alarm to fire headquarters, which was recorded at 3.49. As he was returning, the heated wood gases and smoke which then filled the western end of the dock ignited from the flames coming up the side, and burst into a mass of fire. As described by most of the eye witnesses, there was a puff, and the entire air seemed to turn to flame, without any report or other sound of explosion. From that instant the hose wagon was lost to sight and everyone rushed to the outside for safety. At least three men were either burned alive or drowned, one being the driver of an auto freight truck, who was some distance away. The two firemen on the hose, Patrick Cooper and J. W. Stokes, groped their way as best they could to the doors and then threw themselves into the water. Cooper was fatally burned, but it is believed that Stokes will recover. A number of other men were taken

from the water with minor burns, and it is believed that two or three are missing. Fortunately there were only a few employees present at this time, for when Alaska boats are coming or going, these docks often have several thousand people on them.

Directly after this terrific outburst of flame, the western half of the dock became a mass of fire, and it was said that a straight line of fire advanced along the composition roof of the Grand Trunk dock as rapidly as a man could walk. Within five minutes the rolling doors at the office end dropped and sparks and brands showered the docks and other buildings toward the southeast and down the water front. The people in the Grand Trunk offices had no time to get to the stairs and most of them were at the windows when the fire department arrived. There was great difficulty in preventing them from jumping until the truckmen could raise the ladders and take them to safety. By this time a second and third alarm had been sent in and the fire boat left her berth just north of the Grand Trunk wharf. She was somewhat delayed by steamers getting away from the slips, but started a stream of water which did not make a great deal of impression on the fire. The fires on the Colman dock roof ran together until there was 100 feet burning from eaves to ridge. By this time the fire boat had made her way into the slip used by the ferry boat and by the use of several heavy streams was able to confine the fire to the Grand Trunk side. To the north of Madison Street, land companies and the sprinkler system protected Pier No. 3 until the arrival of the fire boat Snoqualmie, which then took position alongside. The window glass on this dock was cracked and the paint blistered, also many little fires broke out but no serious damage resulted.

The Colman dock was valued at $125,000, with a resulting loss of $7,200. There was very little damage to the ferry landing. The shore or office part of the Grand Trunk Pacific dock had only nominal damage on the first floor, a fire loss of about one quarter on the second, and about one half of the third or top floor. Pier No. 3, the Galbraith-Bacon warehouse, had no loss beyond the breaking of some glass and the blistering of paint.

The Grand Trunk Pacific dock was opened in December, 1910. It was the largest wooden structure of its kind on the Pacific Coast and stood on 5,000 creosoted piles. The dock contained 2,700,000 feet of lumber which cost about $300,000. The heavy flooring was burned almost entirely away at the outer or western end of the dock for about a hundred feet, and the piles and timbers show much more burning than in the remainder of the structure.

H. E. Harvey, driver of the auto freight truck, left his auto at the first outbreak of the fire and helped with the dock hose. He must have rushed to the door and jumped into the water, as his body was found floating in the bay on August 17th. He was not badly burned. It is believed that there are still two or three more bodies under the dock. One fireman was injured after the fire was under control by the cornice of the Grand Trunk dock falling. Seven employees in the office portion,

at the other end of the dock, were so badly injured in escaping from the windows as to be taken to the hospital, and a larger number suffered minor burns or cuts.

The exact cause of this fire will probably never be known, as the testimony of the various dock men and crew of the steamer Athlon is so conflicting. The dock men seem to feel quite positive that the fire was from blazing oil on the surface of the water, which came from the Athlon; whereas members of the crew of that boat were just as positive that the fire was burning on the planking underneath the dock and that there was no oil burning on the water. They were unanimous in their opinion that it was the creosoted piles that made the fire sweep the dock with such rapidity.

H–10376. David Thomas and his six-year old child, together with two children of Mr. and Mrs. Thomas Straight, were burned to death by fire which completely destroyed the Straight Cabin at La Farge, Vernon County, Wis. Mr. and Mrs. Straight were in their stable at the time of the fire. They suddenly noticed the dwelling in flames and rushed to the rescue of their children. Mr. Straight succeeded in saving one of the Thomas children. Mr. Thomas was overcome when he attempted to enter the burning building in an attempt to save the lives of his other child and the two Straight children who were asleep. The floor, weakened by the flames, gave way and Thomas and the three children were thrown into the furnace below.

Although the exact cause of the fire could not be definitely ascertained, it is very probable that either a lamp on the first floor was tipped over or exploded.

H–10151. Four people were burned to death in this dwelling house by fire which is thought to have been caused by one of the boarders, who was in an intoxicated condition, falling upstairs with a kerosene lamp in his hand.

H–10202. This building was one of a row of two-story brick dwellings on a small street. The burned premises were occupied on the first floor as a store; in the rear was a one-story frame structure erected for a bake shop, the principal output being crullers, cakes and pies. The proprietor and his family, which comprised his wife, son and daughter, occupied the dwelling. They were all asleep when the fire occurred.

The fire was first seen by neighbors living in a dwelling in the rear. The outbreak was so sudden that the entire frame structure was enveloped in flames in a very short time. The occupants were awakened, but their escape was cut off by the fire entering the dwelling and extending up the only stairway, at the foot of which the bodies of the proprietor, his wife and son were found after the fire. The daughter escaped from a window.

The fire destroyed the frame bake shop and the better portion of the dwelling. On investigation, the daughter stated that pans of grease were

left on the cooking range to simmer over night, and the sudden and rapid progress of the fire from the start indicates that fire occurred from the ignition of this grease.

This probable cause is one of hundreds of others in different places due to kitchen management, as those who adopt the practice commonly believe that fire must be applied to the grease to cause ignition.

S–16198. This fire took place in the switchboard room of a new building under construction. A painter who was doing some work on the switchboard set a pail of japan paint across two buss bars which carried 250-volt, 1,500-ampere current. The resulting short circuit burned the bottom off the pail, disconnected the buss bars and ignited the paint in the pail which flashed up, throwing burning paint over the man. He fell from the ladder on which he was working and then ran to the door of the room, his clothes afire. At the door he fell unconscious. The other workmen extinguished the fire in his clothes, but he died three days after.

One sprinkler head opened and completely extinguished the fire.

Points of Interest from Fire Reports.

These notes are intended to illustrate the efficiency or inefficiency of signaling, retardant or extinguishing agencies.

Automatic Sprinklers.

S–16236. Automobile on wash stand backfired as it was being started and set fire to leaking gasoline. A sprinkler operated very quickly and so confined the fire that no damage resulted even to the finish of the car from which fire started.

S–16228. This property consisted of a brick and frame building of ordinary hollow joist construction, used as a hospital. Roofs were shingled and gabled with dormer windows in part. There were many concealed spaces, each of which contained sprinklers.

Fire apparently started on the shingle roof in front of the dormer window, from cigarettes thrown away by one of the day orderlies. When discovered, the flames were crawling up the dry shingled roof and by the time an employee brought a one and one-quarter inch hose from a two-inch standpipe located in the hallway into operation, fire had burned through the roof and opened two sprinklers. These did effective work and held the fire in check, being finally extinguished by a chemical stream from the public fire department.

This fire illustrates the necessity for, and the effective work done by, sprinklers in concealed roof spaces.

S–16446. This fire which occurred in a bag of rubbish opened one sprinkler head. When the fire department arrived they had great difficulty in closing control valve on eleventh floor, which would not move more than two inches. In the meantime this single sprinkler head had practically exhausted the water from a 6,000-gallon tank.

S–16169. The large water damage in this factory was caused by the local fire department's men not being thoroughly informed on automatic sprinkler equipments. Fireman from a nearby station heard the motor water gong operating and visited the property from the outside of the building, but decided that there was a leak in the system and returned to the station, leaving the water gong operating without notifying anyone. About three-quarters of an hour later a negro heard the bell and notified the

owner, who closed the main control valve. He found that there had been a fire and that the same had been confined to a very small area and extinguished by one sprinkler head.

S–16183. On the fourth floor of this factory there is a dipping tank twenty-four inches wide, thirty-five inches deep, and seven feet eight inches long, which contains about eight barrels of japan, one-third of which is naphtha. The naphtha vapor became ignited from unknown cause while employee was dipping metal parts in the tank. Forty-three sprinkler heads around and above the tank opened immediately and confined the fire to the vicinity of the tank. On the arrival of the fire department the sprinklers were shut off and four hose streams were played on and around the tank for about two hours to prevent the fire from spreading. The water had no effect upon the fire in the tank, which continued to burn until the contents were consumed. A metal cover was provided for this tank but it had been removed during the day while tank was in use. The tank was not provided with a drain and could not be emptied.

Dip tanks should be constructed in an approved manner so as to reduce their hazard to a minimum.

S–15703. Fire occurred in large wood enclosed veneer dryer, apparently from friction in shafting. This dryer was heated to a temperature of 275 degrees by a well arranged system of hot air blown from coils in the room. Dryer was protected by two lines of 360 degree sprinklers, three of which opened and soon had the fire under control. Fire department used steamer connection and raised the pressure on sprinklers, entirely extinguishing the fire by this means.

Fire Departments.

H–10123. A steel still of 24-inch ordinary brick jacket was used in petroleum oil refinery. The still blew up early in the morning, causing a break in the feed pipes and allowing the oil to flow from it. This oil became ignited from fire-box and a very intense heat was developed. Fire department together with employees used several lines of hose to keep the fire from spreading, but did not turn the streams on to the still, allowing the fire to burn out from lack of fuel. This method seems to have been a good one to follow, for if the water had been turned on the still, it would have merely overflowed the still and caused fire to spread.

H–10149. Fire probably could have been extinguished with only a small loss, had it not been for the construction of an underground or grade crossing of the railroad company. This cut off one hydrant and made it necessary for the fire department to go to the next street corner and lay their hose a long distance. This procedure required considerable time and enabled the fire to make great headway. Loss $35,000.

Fire Doors.

H–10201. Buildings were separated by a fire wall and double automatic fire doors. The Chief of Fire Department advised that he attempted to close the fire doors which did not work. They appeared to be off the track or wedged back so that it was impossible to close them. The fire soon passed through these openings into the adjoining theatre building and the entire block was destroyed.

Fire doors should be regularly examined to see if they are in proper order.

H–10062. Fire spread quickly through all upper floors by way of stairs and elevator shaft, damaging them so that a portion of all the upper floors fell through to the first floor. Stairway was enclosed with single-matched boards; elevator was unenclosed with poorly fitting automatic traps.

Standard trap doors on the elevator and stairway would undoubtedly have checked this fire and prevented its reaching the upper floors.

Thermostats.

S–16510. This fire started from unknown cause in a pile of rubbish and was discovered by an outsider who saw smoke coming from one of the windows. Thermostats did not operate, and it was thought that the sprinklers may have cooled them before the transmitter operated. It was afterwards found, however, that the transmitter was slow in starting, and this may be classed as a transmitter failure. Thermostats were the American ether tube type.

Miscellaneous.

H–10252. This fire, which completely destroyed a garage, did not ignite or injure the gasoline tank of a touring car which was in the garage. The gasoline tank, which was under the front seat, was found still filled with gasoline after the fire, although the front seat was burned away, the radiator of the car melted, and the frame and springs warped by the heat.

Fire Causes.

The fires here given are selected to illustrate defects, either of construction or superintendence, in the classes of property indicated.

Gasoline or Other Volatiles.

H-10281. An employee was working on the scaffolding above one of the percolators containing gasoline in a city garbage plant. One of the incandescent lamps was accidentally broken near escaping gasoline which employee was attempting to locate. The filament in the lamp ignited the gasoline, causing a flash which passed off before employees could get the hand extinguishers to work.

There was no damage to the building or contents, but one of the men was badly burned.

H-10293. This company manufactures a liniment containing about one third turpentine. A batch of this mixture, in an ordinary clothes boiler, was being mixed over the flame of a gas range. The boiler commenced to leak around the bottom edge, allowing the mixture to run out and become ignited by the flames.

Substantial seamless kettles should be used under such conditions.

H-10003. Plumbers were using a small gasoline torch, known as "Banjo torch," for lighting purposes, as the electricity was turned off. Torch was hanging on a wood partition. The torch exploded and set fire to woodwork and damaged surrounding contents. The explosion was probably caused by a leak.

S-16441. Employee had just filled a small glass alcohol lamp which was used in a metal enclosure for melting wax in the finishing department of a furniture factory. The employee spilled a little alcohol on his hands and on outside of lamp, and when he attempted to light the lamp, the flames immediately spread over it. He was forced to drop the lamp on a bench, which caused it to break and ignite the inflammable material on the bench. Another employee quickly used three approved two and one-half gallon chemical extinguishers and the fire was extinguished before the automatic sprinklers fused.

H-10166. A twenty-gallon japan dip tank, the contents of which was thinned with about fifty per cent of naphtha, gave off vapor which circulated through the air and ignited at coke furnace in the next room which was used to heat the japan oven. Fire flashed back to tank and ignited the contents. Prompt action by the public fire department confined the fire to the room of origin.

S–16165. Employee was washing his hands with a silk cloth saturated with benzine and, in rubbing the silk cloth, static electricity was generated which ignited the vapor. The workman in trying to shake the burning benzine from his hands scattered the fire and ignited some benzine in a quart tin pail, which was on a bench nearby. One sprinkler head opened and this together with a chemical extinguisher completely extinguished the fire.

S–16486. This fire occurred in a tobacco warehouse, two stories in height, brick walls and open finish. The building was being fumigated by the use of carbon bisulphide, and the watchman who had become confused thought that another building was the one being fumigated and entered this one with his lantern. The flame from the lantern immediately caused the carbon bisulphide to explode with great violence, entirely demolishing the west end of the building and completely tearing down the sprinkler equipment so that the sprinklers were not a factor in extinguishing this fire, but sprinklers in an adjoining division did operate as well as send in the alarm.

S–16472. In this shoe factory kit tools were heated by gas flame enclosed by a metal jacket, and it is thought that the fumes of a compound used to clean shoes and which contained a large percentage of gasoline came in contact with this flame.

S–16172. Employee who had been cleaning an armature with gasoline used a match to dry the same rapidly. One sprinkler head operated and entirely extinguished the fire.

S–16389. A small amount of gasoline had been drawn from a 50-gallon metal drum into a can. When employee poured the gasoline from the can into a glass bottle, it became ignited.

Electrical.

H–10015. Electric wires which came out at the end of a metal conduit to operate motor had their insulation worn off by the vibration, and this caused a short circuit.

S–16233. A spark from a rheostat used to control the speed of elevator motor fell into an accumulation of oil on floor which set fire to wooden sheathing on side wall.

S–16361. Fire was caused by the blowing of a fuse on the electric lighting system, which set fire to the insulation on the wire and to the woodwork nearby.

H–10372. An electric vacuum cleaner was being demonstrated on a rug in coat and suit store. The insulation of electric wire for the cleaner was defective and became ignited and, in turn, dropped onto rug and set that on fire.

Lightning.

H–10237. During a severe electrical storm a blaze originated under the canopy of a combination gas and electric fixture in a dwelling house. An examination of the gas pipe, which was broken off just below the insulating joint, disclosed a defective weld or crack in the pipe. It is presumed that lightning entered on service wires, seeking the earth through tape on splices or thin insulation on fixture wire and through grounded neutral, and caused a flash under canopy which set fire to gas escaping through defective pipe.

H–10337. Fire was discovered on the outside of a frame dwelling. A vertical strip of the weatherboarding, about four feet wide and extending from the foundation to the roof, was burned away and owing to the fact that a galvanized iron lightning rod extended down this strip, and further that a thunder storm occurred a few hours previous to the discovery of the fire, its origin is attributed to lightning. Although two careful examinations were made of the premises, no direct evidence of any lightning stroke could be found, but neither was there noted any other probable or possible cause of the fire. The electric lighting system was installed in an approved manner and is still in good condition except for slight damage by the fire. Since the lightning rods installed on this building were in no respect according to the standard, it would seem that the fire may have been started by a direct stroke of lightning and that all evidences of the stroke were destroyed by the fire.

H–10359. During an electrical storm, lightning entered a freight storage shed through an overhead service used to supply power to a 15 H. P. motor located on the coffee conveyor. This overhead network has several times in the past conducted lightning discharges into a number of buildings in the immediate vicinity of this shed, and serious fire losses were averted only because of the absence of combustible material at the points where the burn-outs occurred. It would seem as if this hazard could be considerably reduced, if not entirely eliminated, by properly grounding the neutral of this network and placing lightning arresters on the outside wires.

Construction.

S–16300. It is thought that the cause of this fire was either a back fire at the boilers spreading to the shavings on the floor and then creeping into the shavings vault, or from some one smoking and throwing down ashes which set fire to the shavings on the boiler room floor, fire spreading into the vault. After the fire got into the shavings vault it seemed to go up the side and into the twelve-inch concealed space under the roof. Fire burned along this space, opening sprinklers beneath the sheathing in shavings vault, and spread into the concealed space in roof of dry room adjoining. The roof over these rooms was practically destroyed, as the sprinklers could not reach the fire.

The roof is joisted, with wood sheathing twelve-inch below and the sprinklers are placed below this.

Construction with such concealed spaces should be carefully guarded against, as it is almost impossible to extinguish a fire under these conditions without large damage.

H–10370. This fire started in the wood sheathing back of a steam radiator. Live steam at full boiler pressure was used in these radiators, and although there was a space of about two inches between the radiator and the wall, foreign material probably collected and became ignited by the heat. The hollow joist construction of this building assisted in the spread of the flames and made it more difficult to extinguish them. About two-thirds of the roof, also several windows and casings and a portion of the sheathing on three sides, was destroyed.

H–10371. A new brick oven had been installed in this bread bakery, the top came within one foot of the floor above and timbers supporting this floor rested directly on the oven. Apparently the constant heat charred this timber.

A liberal air space should always be allowed between ovens, furnaces and floors above.

H–10369. The fire was caused by the installation of three annealing furnaces in a sheet metal worker, which were placed too close to an unprotected wooden partition, the same becoming ignited from the heat. Fire was extinguished by the use of hand pails before the arrival of the fire department.

S–16289. This fire can without doubt be laid directly to a poorly arranged conveyor system from the openers in the cotton house to the condensers in the picker room. It was arranged so that the cotton would pass through the openers, then through blower or fan, and through galvanized pipe outdoors to condensers in picker room. Cotton passes through condenser and falls to open bins in loose piles. The sides of bin are frame metal-clad, but they are open at the top and front. The arrangement at openers is without a vertical pipe for passage of stock before same passes through fan or blower, and through the absence of this vertical pipe foreign substances can pass directly to fan. This is probably the cause of fire.

The fire was first noticed by an employee who was preparing to leave for the night. He noticed burning cotton dropping from the pipe from condenser and was able to grasp a fairly large lump and rush with same to the window, but in the meantime additional burning cotton had dropped from the pipe and instantly the pile on floor was ablaze. Five sprinklers opened and practically extinguished the fire.

Explosions.

S–16549. A fire or explosion occurred at the sugar mill or pulverizer. This machine was formerly equipped with a metal drum or separator, and the sugar discharged to this separator and then to bins. The explosion seemed to occur when the cover was removed from separator while the machine was in operation. It is probable that a spark or hot bearing facilitated the explosion when outside air entered the separator on removing the cover.

S–16168. There are corrugated disc sugar grinding mills enclosed in sheet iron on the fifth floor of this building. It is reported that the bearings of one mill became worn and allowed the steel mill discs to come in close contact, striking spark which caused an explosion of the sugar dust. The sheet iron casing of mill was blown apart and fire was conveyed through belt hole to the floor below, where a second explosion of sugar dust took place. Thirteen sprinklers opened and practically extinguished the fire.

Spontaneous Ignition.

S–16318. The buffing dust in a shoe factory had been removed from the room during the day and placed in two wooden barrels. The foreman had intended to have these barrels placed outside of the factory in the morning, but fire broke out in one of them before this was done, due to spontaneous ignition in the dust. A sprinkler head nearby opened and completely extinguished the fire.

H–10204. Lard old (used in machines) and oily chips were placed in a metal barrel which rested on a wooden box. This barrel leaked. It is very evident that fire originated under or about this barrel, undoubtedly from spontaneous heating, and made considerable headway before its discovery.

S–16506. Fire started in the bottom of the Bramwell feed end of No. 1 card in an ordinary hosiery knitting plant. It was probably caused by spontaneous combustion in oily waste material which had been dropping from the stock before passing over the feed roll. At this end of the card a metal pan is placed close to the floor and holds stock against the apron. This waste stock had been accumulating in this pan for nearly four weeks, as the grade of material being used had not been changed during that time. This oily material becomes compressed and as stock, which is wool shoddy and comber cotton, is saturated with a mixture of one part saponified oil and two parts water, it becomes heated in time and fire results. This particular afternoon, fire was seen to flash from the rear or feed end of the card and instantly spread over the lint around the cards, badly burning same.

Fuel Oil.

S–16552. This fire was caused by the neglect of an operator to turn off the oil supply to a fuel oil heated rivet furnace. Furnace, being left

without control, apparently overheated, and about an hour after the plant was shut down the wooden frame of a window near furnace was discovered to be on fire.

The oil is piped from an elevated storage tank in yard and is supplied to burners by gravity flow from a small tank, which is filled by gravity from a large one. Valve in supply line from large tank was usually kept closed but valve in line from small tank was only closed when the furnace was not in operation. Apparently the operator neglected to shut off the oil from this small tank when leaving the factory at night.

Fuel oil systems should be made standard, with approved tanks and pumps.

S-16210. Fuel oil feed line from the oil house to factory is arranged to run over the boilers so that the oil may be heated during cold weather. Apparently this line developed a small leak and the oil dripped down through the brick wall of boiler and formed gas. On the night of the fire one of the workmen opened the base of the stack to clean it, and as he entered there was an explosion, the flames shooting up to the roof.

The gas from the fuel oil and the oil itself had accumulated on top of the boiler and burned quickly. One sprinkler opened immediately and practically extinguished the fire.

The joints in the fuel line were made by unions with rubber gaskets which probably became deteriorated and caused the leak.

Pyroxylin Plastics.

S-16487. This fire started from unknown cause in a metal clad stock house containing celluloid. A large amount of scrap had recently been placed in this building, and as some of this scrap was said to be from ten to twelve years old, it was thought that it had commenced to disintegrate and so became sufficiently heated to ignite. An inspection of some of this stock showed it to be badly decomposed and almost ready to fall apart.

S-16193. In this pyroxylin plastic goods factory wooden beads for dipping in colored lacquers are placed on the end of short wires fastened to narrow wood strips. The lacquer which collects on these wires is cleaned off by first soaking in a shallow pan of wood alcohol and then by rubbing against brush ball wheel. It is stated that a new man was doing this work and caused too much friction at the ball wheel, and fire resulted.

Miscellaneous.

H-10113. Fire was discovered by the watchman who detected the odor of smoke and traced it to a pile of bagged raw sugar. The fire appeared among the bagging, and the sugar was in a melted state. The origin of the fire is not known. As sugar had not been known to ignite spontaneously either in bulk or in casks, it would appear as if this fire originated in the bagging which if greasy or bagged while sugar is hot will generate heat sufficiently to become ignited.

H–10232. The operator of a moving picture machine attempted to open the lower magazine door and to turn the crank at the same time. The door stopped the crank long enough for the film to ignite, as there were no automatic shutters on the machine. No damage was caused to the building but about 700 feet of film were burned before the magazine door was closed and the shutters to the booth dropped.

S–16155. The engineer was a new man and did not thoroughly understand the blower system of feeding shavings to furnaces. When the plant was shut down at noon, he did not remove the spout to the boiler furnace. Fire passed up through spout to dust collector on roof of boiler house and from there down to shavings vault. Fire was extinguished by the use of one hose stream and one automatic sprinkler.

H–10374. This turpentine refinery consisted of a steel frame, metal clad, four story building and a destructive distillate refinery, one story in height, of frame construction, metal clad and metal roof. It was occupied by stills, condensers and separators. When the new owner took charge, the "Pope" process, heretofore followed in the retort and condenser shed, was entirely abandoned. This plan brought about one or more changes in the refineries. One of these is especially to be noted in that a certain amount of non-condensible gases was liberated under the roof of the building, immediately after issuing from the worms of the condensers and above the separators. As originally installed, it was arranged to return these vapors to the furnaces where they were burned. This being the plan and probably believing that no inflammable gases would ever be liberated within this building, the one-story destructive distillate refinery was not provided with proper ventilating openings in its upper part. It therefore seems that immediately before the fire the upper part of the building was filled with an inflammable but not explosive mixture of gas. The actual cause of the ignition of this gas will probably never be ascertained. An employee who was in charge of the refineries claims to have heard a hissing sound, and immediately thereafter he claims that the upper and interior part of the one-story destructive distillate refinery was aflame. Several other employees substantiate this and all agree that there was no explosion at the beginning.

H–10219. One of the employees was using an oxy-hydro apparatus (one tank of oxygen and one of hydrogen) for melting and bronzing purposes. He spilled some molten metal from a crucible, which fell on some papers and ignited them. A pan of alcohol was also ignited. The blaze on the floor surrounded a tank of oxygen with sufficient heating effect to increase the pressure of the contents of the tank until it burst with a loud report and with such force as to scatter the contents and wreck the fixtures in the room, including a partition, also the windows on the different floors and the ceiling of the first and second floors.

Two or three of the employees were injured by the broken glass. Fire was extinguished, with slight damage, by the fire department with a chemical extinguisher.

Standard Rules and Requirements

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Dip Tanks	1913
Electric Wiring and Apparatus (Nat'l Electrical Code)	1913
Electrical Fittings, List of Approved	April, 1914
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Fire Doors and Shutters	1908
Fire Pumps (steam)	1911
Fire Pumps (electric)	1904
Fire Pumps (centrifugal)	1911
Fire Pumps (rotary)	1911
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Gasoline Vapor Gas Lighting Machines, Lamps and Systems	1910
Gravity Tanks	1910
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Hose Houses, for mill yards	1905
Kerosene Oil Pressure Systems	1902
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